6. REMEDIAL INVESTIGATION/FEASIBILITY STUDY TASKS

The OU 3-14 RI/FS includes a variety of tasks related to scoping, implementation, and decision-making under the FFA/CO (DOE-ID 1991). Standard RI/FS tasks have been identified by the EPA (1988a) to provide consistent reporting and allow more effective monitoring of RI/FS projects. Proposed activities in each task that will be performed as part of the OU 3-14 RI/FS are discussed below.

Specific details of proposed field activities are described in the FSP (DOE-ID 2004c; see Appendix A), the Quality Assurance Project Plan (QAPjP) (DOE-ID 2004d), the HASP (INEEL 2004a; see Appendix B), and the Waste Management Plan (INEEL 2004b; see Appendix C). These documents are described in Section 6.1, and the remainder of this section is a review of the specific required elements of the RI/FS.

6.1 Project Plan and Scope

This Work Plan is a part of the project planning and scoping task, which involves activities necessary to initiate the OU 3-14 RI/FS (DOE-ID 2000b). Project planning is intended to identify the proper sequence of site activities to accomplish the investigation. The following sections describe the plans developed as part of the planning and scoping process. These plans are prepared in accordance with *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA 1988a).

6.1.1 Field Sampling Plans and Quality Assurance Project Plan

The FSP (see Appendix A) directing tank farm field-sampling activities contains detailed procedures for collecting and analyzing data for the tank farm. The procedures include the sampling objectives, sample locations and frequency, sample designation, sampling equipment, and sample handling and analysis for the OU 3-14 field investigation.

The QAPjP (DOE-ID 2004d) includes procedures designed to ensure the integrity of samples collected, the precision and accuracy of the analytical results, and the representativeness and completeness of environmental measurements collected for OU 3-14. The QAPjP, written in accordance with RI/FS guidance, discusses the following elements:

- Idaho Completion Project (ICP) description
- Project organization and responsibility, including the job titles of individuals responsible for ensuring that the environmental data collected are valid
- Quality assurance objectives for data, including required precision, accuracy, representativeness, and completeness and the allowed use of the data
- Sample custody procedures and documentation
- Calibration procedures and frequency
- Analytical procedures with references to applicable standard operating procedures
- Data reduction, validation, and reporting procedures
- Internal quality control procedure description or reference

- Performance and system audits
- Preventive maintenance procedures
- Specific routine procedures used to assess data accuracy, precision, and completeness
- Corrective action procedures
- Quality assurance reports, including results of system and performance audits and assessments of data accuracy, precision, and completeness.

6.1.2 Health and Safety Plan

The HASP (see Appendix B) establishes the procedures and requirements that will be used to eliminate or minimize health and safety risks to persons performing tasks for the OU 3-14 tank farm soil remedial investigation. The HASP has been prepared in accordance with the Occupational Safety and Health Administration standard (29 CFR 1910.120; 29 CFR 1926.65). The HASP contains information about the hazards involved in performing the work and contains the specific actions and equipment that will be used to protect persons while they are at the task site. Project activities and hazards have been evaluated and are within the INTEC safety authorization basis (DOE-ID 2000b), as defined by DOE O 5480.23, "Nuclear Safety Analysis Reports."

The HASP also contains the safety, health, and radiological hazards assessments for executing all OU 3-14 tank farm soil remedial investigation tasks. The intent of the HASP is to identify known hazards and serve as a plan for mitigating them.

6.1.3 Waste Management Plan

The Waste Management Plan (see Appendix C) identifies the potential waste types and quantities expected to be generated during implementation of the remedial investigation. It addresses the various waste stream sources and classifications and provides for waste stream disposition. The Waste Management Plan is written in accordance with federal and state regulations, and it discusses specific requirements for waste characterization, storage, and disposition under those regulations.

6.1.4 Data Management Plan

All data generated as a result of the field investigation will be managed in accordance with the requirements specified in the "Data Management Plan for the Idaho Completion Project Environmental Data Warehouse" (PLN-1387).

6.2 Quality Assurance and Quality Control

The QAPjP for WAGs 1, 2, 3, 4, 5, 6, 7, and 10 and inactive sites (DOE-ID 2004d) pertains to quality assurance and quality control for all environmental, geotechnical, geophysical, and radiological testing, analysis, and data review. The attached FSP details specific requirements to support the OU 3-14 field investigation, including quality assurance/quality control requirements for all sample and analyte types that may potentially be collected.

6.3 Data Management and Evaluation

This section discusses the approach to managing and evaluating field and laboratory data collected for the OU 3-14 field investigation. Field data (e.g., downhole gamma and soil moisture flux data) will be collected electronically. Initially, they will be maintained and managed by the OU 3-14 project manager for the specific data set. The Hydrogeologic Data Repository will provide long-term management for all field data. Laboratory data (e.g., soil and pore water analytical results) will be evaluated and validated by INEEL Sample and Analysis Management and managed and maintained by the Integrated Environmental Data Management System (IEDMS). All data management will follow guidelines specified in the "Data Management Plan for the Idaho Completion Project Environmental Data Warehouse" (PLN-1387) and in the following sections.

6.3.1 Laboratory Analytical Data

Analytical data are managed and maintained in the IEDMS. The components that make up IEDMS provide an efficient and accurate means of sample and data tracking.

The IEDMS performs sample and data tracking throughout all phases of a sampling project beginning with the assignment of unique sample identification numbers using the Sampling and Analysis Plan (SAP) Application Program. The SAP Application Program produces a SAP table that contains a list of sample identification numbers, sample demographics (e.g., area, location, and depth), and the planned analyses. Once the SAP table is finalized, it is used as input to automatically produce sample labels and tags (with or without barcode identification). In addition, sampling guidance forms can be produced for the field sampling team; these forms provide information such as sampling location, requested analysis, container types, and preservative.

When the analytical data package (sample delivery group) is received, it is logged into the IEDMS journaling system, an integrated subsystem of the sample tracking system, which tracks the sample delivery group from data receipt to the Environmental Restoration Information System. Cursory technical reviews on the data packages are performed to assess the completeness and technical compliance with respect to the project's analysis-specific task order statement of work. Any deficiencies, resubmittal actions, or special instructions to the validator are recorded on the Cursory Subcontractual Compliance Review form using the Laboratory Performance Indicator Management System. This form is sent to the validator with the data package (when required).

Errors in the data package are resolved among all pertinent Sample and Analysis Management chemists, the originating laboratory, and the IEDMS staff. Data validity is ensured by the validator through the assignment of method validation flags. The validator generates a limitations and validation report, which gives detailed information on the assignment of data qualifier flags. A copy of the form accompanies the report with the assigned data qualifier flags and any changes to the data, which are entered into the IEDMS database. From this database, a summary table (a result table) is generated. The result table summarizes the sample identification numbers, sample logistics, analytes, and results for each particular type of analysis (e.g., inorganic, radiological, and organic) from the sampling effort.

6.3.2 Field Data

Field data include all data that are nonchemical analytical data generated in support of OU 3-14. These data will be managed in accordance with the requirements specified in the "Data Management Plan for the Idaho Completion Project Environmental Data Warehouse" (PLN-1387). Final field data will reside in the Hydrogeologic Data Repository for long-term management. These data will be analyzed using methods that are appropriate for the data types and specific field conditions. Analysis will include recognized methods and techniques that are used with the specific data types and may include statistical processes.

6.3.3 Data Evaluation

Data evaluation will depend on the type of data (e.g., laboratory or field) and data uses and will follow procedures defined in the work plans for individual tasks.

6.4 Risk Evaluation and Methodology

This section summarizes the methodology for the BRA that will be performed for OU 3-14. The risk evaluation approach will in general be consistent with the OU 3-13 RI/BRA (DOE-ID 1997a) approach (with revised future use scenarios, as described in Sections 3 and 5) and with updates to the CSM, conceptual model, and numerical model.

The purpose of the BRA is to determine potential adverse human health effects posed by COPCs identified at OU 3-14 under the No Action Alternative (DOE-ID 1991). Typically, BRAs are composed of two parts: a human health evaluation and an ecological evaluation. The OU 3-14 RI/BRA will focus solely on the human health evaluation, because an ecological evaluation has already been performed for the OU 3-13 RI/BRA. The results of the ecological evaluation suggest tank farm soil contamination is unlikely to result in a significant decline in the health or diversity of INEEL-wide ecological communities.

The procedures used in the BRA are consistent with those described in the following guidance documents:

- "Risk Assessment Guidance for Superfund," *Human Health Evaluation Manual (Part A), Volume I* (EPA 1989)
- "Supplemental Guidance for Superfund Risk Assessments in Region 10" (EPA 1991)
- *Guidance Protocol for the Performance of Cumulative Risk Assessments at the INEL* (LITCO 1995b).

The OU 3-14 RI/BRA will be similar in format to the OU 3-13 RI/BRA (DOE-ID 1997a) and will draw from the results of that evaluation. As a result of the large uncertainty in the tank farm contaminant inventories and the groundwater flow and transport model parameters used in the OU 3-13 RI/BRA, tank farm contaminant inventories will be evaluated as part of the OU 3-14 RI/BRA. The evaluation will be achieved primarily through additional downhole gamma logging and sample collection, the goals of which are to reduce uncertainty related to the nature, extent, and distribution of contamination. The risk assessment will include the cumulative groundwater risk presented by OU 3-13 and 3-14 sources to a receptor and will update the OU 3-13 RI/BRA calculations and scenarios.

The human health BRA for OU 3-14 will include the following components:

- **Human Health Hazard Identification.** The human health hazard identification process will determine the site environmental conditions (including current and future land use), contaminant sources, contaminant release rates, exposure pathways, exposure routes, and receptor locations, based on the CSM for OU 3-14 presented in Section 3.5. The CSM for OU 3-14 will be revised and updated as needed during the BRA to provide a current understanding of the system and provide a basis for identification of the potential exposure scenarios.

- **Data Evaluation and Identification of COPCs.** This step will summarize the data collected for OUs 3-13 and 3-14 and will describe the screening evaluation used to identify and select contaminants that are of potential health concern at the site.

- **Exposure Assessment.** An exposure assessment is conducted to estimate the magnitude of potential human exposures, the frequency and duration of these exposures, and the pathways through which humans are potentially exposed to COPCs at the site. The exposure assessment involves evaluating the fate and transport of chemical releases from the site, identifying potentially exposed populations and pathways of exposure, estimating exposure point concentrations for specific pathways, and estimating chemical intake rates in humans.

- **Exposure Scenarios.** The OU 3-14 RI/BRA will address both current and future worker exposure scenarios. The future worker scenario will begin in 2095. A future groundwater exposure scenario will be addressed for the following 900 years after the 100-year occupational scenario. This provides a total 1,000-year exposure timeframe at the tank farm. These assumptions could be modified based on evolving land use plans at the INEEL. In addition to the 1,000-year total exposure evaluation for risk assessment, the risk for the groundwater pathway will be calculated to the time of the peak predicted risk at the exposure points.

- **Exposure Pathways and Routes.** The exposure pathways to be assessed, as identified in Section 3.5, include the subsurface, air, and surface pathways. The exposure routes to be addressed are as follows:

    - Current and future workers

        - Soil ingestion

        - Dermal exposure to soil

        - Inhalation of dust

        - Direct exposure to ionizing radiation

    - Future residents

        - Groundwater ingestion

        - Groundwater inhalation

        - Dermal exposure to groundwater.

- **Toxicity Assessment.** The toxicity assessment will involve the characterization of the toxicological properties of and health effects from COPCs, with special emphasis on defining their dose-response relationships. From these dose-response relationships, toxicity values are derived and can be used to evaluate the potential occurrence of adverse health effects at different levels of exposure.

- **Risk Characterization.** Risk characterization will combine the results of the exposure assessment and toxicity assessment to characterize risk to human health, both in numerical expressions and qualitative statements. Carcinogenic and noncarcinogenic health effects will be addressed. Risks and hazard quotients will be calculated using a 25-yr running average concentration for the occupational scenario and a 30-yr running average for the residential scenario. A time history of risks will be provided for the exposure routes. Time histories of the risk will be presented graphically, and maximum risks will be tabulated for the occupational and residential exposure scenarios.

- **Qualitative Uncertainty Analysis.** The uncertainties in the risk assessment process and how these uncertainties influence the characterization of health risks will be analyzed qualitatively. The qualitative uncertainty analysis will include a discussion of the uncertainty associated with the following components of the system:
  - Physical setting (current land use, future land use, and exposure pathways)
  - Contaminants not included as COPCs in the OU 3-14 RI/BRA
  - Conceptual model uncertainties (key model assumptions and model parameter uncertainty)
  - Toxicity values
  - Exposure parameters.
- **Quantitative Sensitivity and Uncertainty Analysis.** A quantitative sensitivity analysis will evaluate the sensitivity of parameters of the contaminant inventory, source term model, fate and transport model, and risk assessment model. Scenarios to be evaluated will be determined during the RI/BRA process.

6.5 Additional OU 3-14 Investigations

Additional components of the OU 3-14 remedial investigation beyond the Phases 1 and 2 field activities are discussed in more detail below. These components consist of contaminant transport studies, treatability studies, and safety assessments.

6.5.1 Contaminant Transport Study

The INTEC conceptual and numerical models will be updated to support the development of the RI/FS. Most of the model development work will be conducted under the accelerated OU 3-14 modeling effort. Three tank farm data collection tasks related to the contaminant transport task will be completed and were identified in Section 5.2.3.2. These are site-specific infiltration rates, water balance data for the northern INTEC, and site-specific geochemical parameters. Data for estimating site-specific infiltration rates will only be collected if the infiltration rates used in the accelerated modeling result in simulated soil radionuclide profiles inconsistent with the observed values.

6.5.1.1 Infiltration Rates. Section 5.2.3.2 identified spatially variable soil-moisture content and soil-moisture tension measurements in tank farm soils as data inputs that will be required to determine infiltration rates. Infiltration rate is a sensitive parameter in the contaminant transport model because water is the primary vehicle for transport of contaminants from the contaminated soils as well as from the grouted tanks and piping. Infiltration is highly dependent on soil type, topography, and surface cover and, in the tank farm, is also affected by aboveground and belowground engineered structures.

The OU 3-13 RI/BRA (DOE-ID 1997a) developed precipitation recharge estimates from data collected at the RWMC (Martian 1995). Infiltration characteristics for the RWMC are substantially different than those at INTEC. Infiltration rates are typically higher in gravelly sand soils, such as those at INTEC, than the silt and loam soils found at the RWMC. Modeling was performed to quantify observations of moisture moving into the soil at 17 NPATs located across the Subsurface Disposal Area of the RWMC (McElroy 1990, 1993; Bishop 1995). Models were calibrated using several years of moisture content data. The data also included companion soil-moisture tension data at two of the NPAT locations. The infiltration behavior varied widely between monitoring locations, and the primary mechanism for recharge was identified as infiltration from melting snow each spring. The fast snowmelt during periods of low evapotranspiration resulted in a large percentage of the annual precipitation becoming recharge even though the total potential evapotranspiration at the Subsurface Disposal Area is several times the annual precipitation. The OU 3-13 RI/BRA recharge rate may not be appropriate for the tank farm, because recharge resulting from precipitation is strongly dependent on soil type, topography, and surface vegetation type, which are very different at the tank farm than at the RWMC. Furthermore, the tank farm soil has been covered by an impermeable liner overlain by gravel. The liner has been breached many times during maintenance operations; however, it reportedly has always been patched afterward. Drainage areas that receive run-off from rooftops and roads could experience significant infiltration, but the Tank Farm Interim Action partially addressed these sources. In other areas, the combination of gravel over a compromised impermeable barrier most likely maximizes infiltration by limiting evaporation and focusing recharge through any liner breaches. The liner is also nearing the end of its functional design life and deterioration is expected to accelerate.

Two characteristic infiltration rates are needed for the OU 3-14 RI/FS. The first represents long-term infiltration through INTEC's disturbed alluvial soils without engineered structures (e.g., impermeable liners and buildings). This value will be used for long-term simulation of contaminant transport in the BRA. The second value will be used to represent realistic infiltration through the tank farm soils as has occurred from the time of release to present. This value is needed to evaluate the effects that potential remedial alternatives would have on groundwater risk.

A 1993-1994 soil moisture study (LITCO 1995a) and the method presented by Martian (1995) will be used to estimate the infiltration rate through the tank farm soil by simulating infiltration patterns seen in the soil moisture monitoring as part of the accelerated OU 3-14 modeling. The recharge rate will be used as the surface recharge boundary in the accelerated RI/BRA contaminant transport modeling. Additional soil moisture and matric potential monitoring will be performed if simulated radionuclide profiles in the soil are inconsistent with measured profiles.

6.5.1.2 Water Balance. Section 5 identified the need for water balance data for northern INTEC and identification of perched water recharge sources to support the OU 3-14 tank farm modeling. Currently, the OU 3-13 Group 4 project is tasked with conducting a series of water balance studies that will provide the necessary data to support OU 3-14 tank farm modeling. These studies include a time-series analysis of perched water and recharge sources (use of spectral analysis to identify common high-energy frequencies in perched water and possible recharge sources), an analysis of the effects of relocation of the percolation ponds and recent Big Lost River cessation (drought) on perched water elevations, estimation of vadose zone hydraulic properties, and development of a comprehensive inventory of anthropogenic recharge sources. The Group 4 study activities and schedule will be coordinated with this project to ensure that OU 3-14 DQOs are addressed.

6.5.1.3 Geochemical Properties. Section 5 identified the need for contaminant-specific K_d values for contaminants in alluvial soils, sedimentary interbeds, and basalt that are representative of tank farm conditions. The consequences of not gathering site-specific data are that transport rates could be overestimated or underestimated in the contaminant transport modeling, increasing uncertainty in risk predictions. To resolve this uncertainty, OU 3-14 will conduct an analysis of available data for the geochemical properties of the subsurface porous matrix and the chemistry of tank farm alluvial pore water (solution chemistry). As a result of the analysis, contaminant-specific soil/water distribution coefficients may need to be determined experimentally to resolve significant uncertainties within the context of risk analysis.

The approach for determining distribution coefficients is described in the sections that follow. However, K_d values of zero will be assumed for all constituents for basalt in the vadose zone for the purpose of the initial sensitivity analysis. Measuring appropriate parameters to model retardation in fractures is generally difficult. Laboratory methods frequently involve crushing the rock matrix to create high enough surface areas so partition measurements can be made. This exposes mineral surfaces that are not representative of those found in fractures and that are probably more reactive. In addition, rapid flow in fractures reduces the time available for equilibrium or steady-state partitioning to be established.

Decisions regarding the need to experimentally measure distribution coefficients for plutonium will be based on the outcome of a sensitivity analysis. Modeling of plutonium movement in the subsurface will be performed to determine hypothetical threshold K_d values that result in an unacceptable groundwater risk (>MCL). Repeated simulations using decreasing K_d values will be performed with the calibrated model until the simulated inventory exceeds MCLs in the Snake River Plain Aquifer. The effort and precision required to perform a site-specific plutonium K_d study for INTEC, or whether to perform one at all, will depend upon how close the threshold K_d value is to the reasonably conservative but technically defensible K_d value for Pu based on published literature and laboratory reports. If the threshold plutonium K_d is relatively small compared to the known range of possible values from the literature, a complex/expensive plutonium mobility laboratory study is not warranted. However, if a relatively large K_d value still poses a risk to the aquifer, a laboratory K_d study may be needed. Due to the unusual chemical properties of Pu, determining representative K_d values for Pu can be difficult. An approach for Pu similar to that used by WAG 7 will be used (Holdren et al. 2002). In this approach, a fraction of Pu will be assumed to be transported colloidally based on properties of INTEC materials and waste. Site-specific K_d values for Pu will not be available in time for use in the accelerated 3-14 baseline risk assessment modeling.

The analysis of threshold K_d values will also evaluate a threshold mobile (colloidal) fraction of Pu that would have to be exceeded to show an aquifer risk. This evaluation will estimate the mobile fraction that would be required to produce Pu concentrations above the detection limit in the interbed soils and/or perched water beneath INTEC. The conceptual model will include an assessment of physical and chemical processes that could lead to facilitated Pu transport in the tank farm, such as formation of Pu-containing colloidal particles during the reaction of low pH tank farm liquid waste with minerals in the soil, and Pu adsorbing to native colloids.

General and site-specific factors that relate to K_ds and modeling contaminant transport at INTEC are presented in the next two sections.

6.5.1.3.1 K_d Parameters for Transport Modeling: Principles—Modeling the subsurface transport of contaminants requires parameters that describe solute partitioning (or distribution) between the mobile (water) and immobile (rock/soil) phases. Transport models most often use a linear sorption isotherm where the mass of contaminant sorbed onto the soil (or other geologic media) is a function of the aqueous concentration and the K_d. In computer modeling, K_ds are used as a mathematically simple representation of sorption and encompass all the processes that remove a contaminant from solution and represent the ratio of adsorbed-to-dissolved concentrations. The K_d expression is given by

$$Kd_i = \frac{\left(S_{i,sorbed} \big/ M_{solid} \right)}{(C_i)}$$

where Kd_i is the partition coefficient for solute i, $S_{i,sorbed}$ is the mass of solute removed from solution in the presence of a mass of solids, M_{solid}, and dissolved concentration is C_i. K_d parameters for solutes are determined either experimentally or by fitting laboratory or field transport data with effective K_d values. Numerous critical assumptions must be satisfied when applying K_d parameters. The system should represent equilibrium or steady-state conditions, the proportionality between solid mass and the mechanism for solute partitioning must be constant, dominant field conditions must be represented by the laboratory systems, and the reactive surfaces in the laboratory must be those that actually exist in the field. However, K_d measurements can capture a complex assembly of reactions that usually cannot be determined individually in natural systems. K_ds are a sensitive and uncertain parameter in the tank farm contaminant fate and transport model.

Because field data are often insufficient to determine actual sorption, K_ds are typically obtained by fitting a linear isotherm to results of batch or column experiments, which neglects the actual mechanisms responsible for contaminant removal. In such tests, the target media are exposed to solutions of water with known concentrations of contaminants (or surrogate compounds) under chemical conditions designed to represent the actual field environment (such as the composition of the pore fluid as described in the previous section).

6.5.1.3.2 K_d Parameters for Transport Modeling: Approach for INTEC—Solute or colloid partitioning between solid and aqueous phases is determined by reactions between contaminants and solid surfaces, reactions with other dissolved solutes, competing reactions involving groundwater solutes, and processes affecting mass transfer such as diffusion or advection. At the tank farm, estimating the extent of contaminant sorption is complicated by the extremely acidic nature of the aqueous waste. Low pH conditions generally reduce the sorption of cations (metals, including radionuclides, are cationic at low pH) for several reasons, including competition between metals and hydrogen ions reactive surface sites and the surface charge of minerals being a function of pH. Due to the presence of carbonates in the alluvial soil, however, low pH conditions are not expected to persist. At CPP-31, for example, the acid components of liquid wastes should have been quickly neutralized,[a] because the volume of soil contacted by the released waste, with an estimated field capacity moisture content of 0.11, has sufficient carbonate. At other sites, such as CPP-28 or high-contamination areas near borehole 79-1, volume of soil contacted and reacted with is uncertain. In these areas, direct measurement of pore constituents is needed to determine the extent of acid neutralization and mineral dissolution.

Although acid wastes may have been effectively neutralized, competition from groundwater cations (e.g., Ca^{2+} and Mg^{2+}) likely will have a significantly greater effect on increasing radionuclide mobility than persistent low pH conditions from the release. Ca^{2+} and Mg^{2+} will also be increased as a consequence of acid-neutralizing reactions. High concentrations of Ca^{2+}, Mg^{2+}, and other cations in the INTEC perched water suggest that these would also be present in alluvial pore water. The presence of Ca^{2+}, Mg^{2+}, and other cations in alluvial pore water will have reduced sorption of radionuclides due to competition for sorption sites. Some of the cations, along with other dissolved constituents, may be the product of acid dissolution of the native minerals as the waste migrates.

To account for reactions between the acid wastes and the subsurface minerals, the buffering capacity of the alluvium will be estimated using data on the mineralogy specific to the tank farm soil and chemical analysis of tank contents. Thermodynamic and limited kinetic calculations (using suitable programs such as Geochemist's Workbench [Bethke 2002]) will also be conducted in an effort to predict how waste-mineral reactions might alter the solution chemistry of pore fluids prior to dilution by infiltrating water. Direct measurements, if determined to be necessary, will be conducted on interbed

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a. Assuming a 14,000-gal release of 1.4 *M* acid concentration; alluvium contains 6 wt% calcite/dolomite; 0.11 field capacity moisture content; personal communication, P. Martian, Bechtel BWXT Idaho, LLC, 2003.

samples that have been archived from earlier sampling projects. If necessary, soil samples may also be collected from specific release sites and analyzed during Phase 2 of the field investigation.

Factors that are necessary to include in the design of batch or column tests include the oxidation state of the contaminants, the oxidation conditions of the system, the solution chemistry for the infiltrating water, the geochemical properties of tank farm alluvium (natural and as altered by the waste releases), interbeds, and alteration of the samples used in the experiments. In addition, investigators need to determine the appropriate mineralogy, contaminant concentration, particle size, temperature, and atmospheric conditions (soil gas) for the tests. The approach for developing defensible contaminant-specific sorption properties includes literature studies, possible bench-scale batch and column tests on actual and surrogate materials, and field calibration data collection. If laboratory tests are necessary, the approach will be documented in a detailed test plan to be developed after the accelerated model is complete.

On the basis of previous risk modeling, isotopes of strontium, neptunium, and plutonium are identified as the primary contaminants of interest for sorption studies. For Sr-90, there are a number of existing studies that have examined sorption to INTEC sediments and basalt (e.g., Liszewski et al. 1997, 1998; Hawkins and Short 1965; Del Debbio and Thomas 1989; Bunde et al. 1997). Once alluvial pore water chemistry is examined, obtaining a representative Sr-90 K_d value from these and other reports is anticipated. No INTEC-specific data for neptunium exists. From experience at the RWMC, neptunium K_d values are expected to be derived from a series of batch adsorption experiments per ASTM-D-4319.

Plutonium is a chemically complex element for which derivation of linear isotherm partition coefficients has proven difficult. Plutonium can be present in multiple oxidation states, depending on the composition of the system, and is subject to dissolved transport and particulate transport through attachment to colloids. Literature values for plutonium K_ds are highly variable (Dicke 1997). The approach selected to identify a representative plutonium K_d for OU 3-14 is to first conduct a review of literature that has critically evaluated Pu partitioning while accounting for its complex chemistry. Based on the results of the literature review, the accelerated INTEC groundwater model will be developed and a sensitivity analysis performed. If necessary, testing may proceed to bench scale to measure wash-off from contaminated sediments. Sequential extraction of soil samples would be conducted using water, weak acid, an oxidizer, and a strong acid to discern under what conditions, if any, the plutonium can be mobilized. This information would help investigators to select appropriate conceptual models for release and transport and to identify what parameters are necessary to quantify partitioning. Finally, if warranted by the results of the literature review and sequential extraction tests, a series of column tests would be conducted. Column tests will be particularly important with respect to determining the importance of colloid facilitated transport of Pu.

Because transport and adsorptive characteristics of contaminants, particularly actinides, are strongly affected by their initial oxidation state and by oxidation/reduction reactions within the vadose zone, column studies with filtration of outflow for plutonium at three oxidation states (IV, V, and VI) may be performed. Because traditional batch sorption experiments assume a single physical/chemical form of contaminant, column studies are recommended for investigating actinide mobility (Fjeld et al. 2000). Depending on the results of the tests, multi-mobility models may be used to represent fractions with differing solubility. The tests would also examine the importance, and possible in situ formation, of colloids and ligands under tank-farm-specific geochemical conditions. Because the majority of plutonium does not exhibit breakthrough during test periods, the test columns may be segmented and analyzed to determine what distance through the column plutonium may have moved in order to derive an observed retardation factor.

Some tank farm alluvium and interbed samples have been archived from past investigations and will be evaluated for possible use in OU 3-14 sorption studies. Depending on the representativeness of these samples, additional soil samples may need to be collected. High radiation levels may possibly preclude collection and testing soils from some areas.

In summary, to improve the fate and transport modeling of contaminants from the tank farm, pore-water solution properties and mineralogy from the alluvium may be needed to derive defensible minimum retardation factors. Depending on the outcome of the sensitivity analysis, performing laboratory-based K_d measurements for strontium, neptunium, and plutonium that capture more solute and colloid transport mechanisms may be necessary. By determining the range of K_d values for site-specific materials and water chemistry, investigators will be able to select conservative, yet representative, values; defend the risk assessment; and, ultimately, defend the selection of an appropriate remedial action.

6.5.2 Treatability Study

As discussed in the RI/FS guidance (EPA 1988a), site characterization and treatability investigations are two of the main components of the RI/FS process. As site and technology information is collected and reviewed, additional data needs for evaluating alternatives are identified. Treatability studies may be required to fill some of these data gaps. Pre-ROD treatability studies may be needed when potentially applicable treatment technologies are being considered for which no or limited performance or cost information is available in the literature with regard to the waste types and site conditions of concern. Post-ROD or RD/RA treatability studies can provide the detailed design, cost, and performance data needed to optimize treatment processes and to implement full-scale treatment systems. When implementing a remedy, RD/RA treatability studies can be used to select among multiple vendors, implement the most appropriate of the remedies prescribed in a contingency ROD, or support detailed design specifications.

Although certain post-ROD treatability studies are appropriate, conducting treatability studies during the RI/FS can reduce the uncertainties associated with selecting the remedy, provide a sounder basis for the ROD, and possibly facilitate negotiations between the Agencies without lengthening the overall cleanup schedule for the site. Because treatability studies may be expensive, however, careful consideration needs to be given to the decision as to what and when to test. A remedy selection treatability study should be designed to verify whether a process option can meet the OU's cleanup criteria and at what cost. The purpose of a pre-ROD treatability study is to generate the critical performance and cost data necessary for remedy evaluation in the detailed analysis of alternatives during the feasibility study. Investigation of equipment-specific parameters or design-level detail should generally be delayed until post-ROD RD/RA studies. Results of remedy selection treatability studies allow for estimating the costs associated with full-scale implementation of the alternative(s) within an accuracy of +50/-30%, as suggested for the feasibility study by CERCLA guidance (EPA 1988a).

Several remedial technology data gaps were identified in Section 5 and need to be addressed to support selection and implementation of remedial alternatives, including in situ and ex situ treatment, either pre- or post-ROD. If performed, candidate technologies for treatability studies will be reviewed using EPA guidance for selecting treatability studies (EPA 1992). This guidance provides a method to evaluate which treatability studies should be performed to support the feasibility study and the ROD. The evaluation will be based on the significance of feasibility study data gaps associated with each technology and whether bench-, pilot-, or field-scale testing would be necessary. Other factors to be considered are budget and schedule constraints, technology availability, maturity of new technology, and site-specific conditions. At least one technology, grout/polymer encapsulation, is anticipated to warrant a remedy-selection treatability study, as described below. This technology may be applied in situ or ex situ, and each has process-specific data requirements that may merit treatability studies. In situ grouting is described below, and many of the specific treatability study elements apply to ex situ grouting as well.

Treatability study work plans will be prepared for any treatability study performed. The work plan will be the key document to define the study objectives and work scope and will be prepared in accordance with CERCLA treatability study guidance (EPA 1992). Treatability study summary evaluation reports will also be prepared, as required. Other project documents that will be prepared specifically for the treatability study include test plans, SAPs, safety assessments, HASPs, and waste management plans.

Grout/polymer encapsulation is a representative in situ or ex situ treatment technology that would likely require treatability studies before implementation. Grout/polymer encapsulation entails injecting or mixing a slurry-like mixture of cements, chemical polymers, or petroleum-based waxes into contaminated soil or waste. Stabilizing agents are specially formulated to encapsulate contaminants and isolate them from the surrounding environment. In the environmental industry, the process is described as nondisplacement jet grouting, or in situ grouting, where soil and grout are mixed below the surface, forming a large area that is physically and/or chemically stabilized (Loomis et al. 2002). When properly designed and applied, in situ grouting produces a durable waste form resistant to weathering and degradation over long periods.

Extensive research at the INEEL and other DOE sites has been conducted to evaluate the effectiveness and technical feasibility of in situ grouting. As a result, the implementability of in situ grouting equipment and processes is generally well understood. Although specific grouting parameters (e.g., injection pressures, grout viscosities, and injection point spacing) need to be developed on a site-by-site basis, this information is more critical during the remedial design phase than during the feasibility study.

Feasibility study data needed to support evaluation of the long-term effectiveness of in situ grouting for tank farm soils include expected release rate of contaminants from the treated soils. Because grouted waste forms typically exhibit very low hydraulic conductivity, the dominant mechanism of release is diffusion, where contaminants are dissolved and diffuse through relatively static intergranular water to edges of the grout block. From there, infiltrating water transports the contaminant away from the contamination area. In order to model post-treatment release rates and resulting risk in the feasibility study, investigators need estimates of contaminant-specific pore water concentrations and diffusion coefficients.

Typically, diffusion coefficient data are derived from short-term (90-day) bulk leach methods such as the "American National Standard Method for the Measurement of the Leachability of Solidified Low-Level Radioactive Wastes by a Short Term Test Procedure" (ANS/ANSI-16.1). The standard test requires a monolithic sample (cylinder) and demineralized water leachant. The leachant is extracted and replaced at specified time intervals with new water. Given the geometry of the specimen and the leachant composition over time, the diffusion coefficient can be computed and a leachability index assigned. The leachability index is a numerical score used to compare retention of nonvolatile waste components within porous waste-form materials. The leachability index is the negative exponent of the effective diffusion coefficient of the chemical specie of interest. Diffusion is largely dependent on grout type and, to a lesser extent, on chemical species of the contaminant (Weidner et al. 2000).

Though other methods can be used to analyze release (e.g., using the water infiltration rate combined with a retardation factor, as presented by Hull and Pace [2000]), release of contaminants from grout waste forms traditionally has been evaluated using diffusion coefficients derived from ANS/ANSI-16.1 or similar tests. To support the feasibility study, a literature review will be conducted to compile and evaluate available diffusion coefficient data applicable to tank farm contaminants of interest. Then, if insufficient data are available for certain contaminants or candidate grout products, leach tests will be planned and conducted to evaluate the performance of selected grout types with tank farm contaminants of interest.

Leachability of the grout material may be affected by chemical properties of the waste site soils. Most cementations grouts are alkaline, and, though it may be nearly in equilibrium with native INEEL soils, the potential effects of low pH tank farm soils on grout durability have not been investigated. Although the buffering capacity of most grouts likely would far exceed the soil acidity, the potential interactions, given candidate grout types and possible soil pH conditions, have not been investigated or documented. If geochemical calculations indicate potential interferences, additional bench studies will be conducted to quantify the effects of acidic soils on the grout leach index. Preferably, actual soil samples from known release sites will be used in the bench tests. However, if actual samples from the release point prove impractical to retrieve and test due to high levels of radiation, surrogate samples may be chemically altered before testing to represent conditions thought to exist in the release areas.

In regards to standard leach tests, the chair of the ANS/ANSI-16.1 working group recently commented that for purposes of evaluating in situ grouting at the INEEL, the test should be modified to produce data more representative of the waste environment.[b] Using deionized water, in equilibrium with air and with frequent changeout as called for by the procedure, is not representative of actual subsurface conditions. Running a static test to obtain leachability indices and equilibrium distribution with the monolithic sample was recommended. Longer-term leach tests (multiple years) may also provide useful data. In addition, Eh and pH should be measured under an inert gas blanket to discern the actual effect on water chemistry. Finally, simulated water(s) should be tested to evaluate actual solubility potential in the tank farm environment. These recommendations will be considered in the design of the OU 3-14 treatability study.

In addition to leachability of contaminants from specific grouts, the dissolution rate of the grout itself is an important data need, because it helps support the long-term effectiveness evaluation. During the bench tests, the effective diffusion coefficient and leachability index of component elements (e.g., calcium, aluminum, and silicon) will also be measured. Results will indicate durability of the waste form and may allow investigators to evaluate the expected performance life of the waste form.

6.5.2.1 Safety Assessment for High Radiation Soil Excavation and Handling. The presence of contaminated areas with strong radiation fields and a broad range of radiological and chemical contaminants significantly complicates the feasibility study evaluation of remedial alternatives. Past borehole logging identified high radiation areas in the vicinity of the known release sites (e.g., up to 50 R/hr at CPP-31, 25 R/hr at CPP-27, 40 R/hr at CPP-28, and 90 R/hr at CPP-79). To comply with occupational exposure limits, intrusive activities in these areas would undoubtedly require specialized engineering design for remote handling, shielding, and confinement systems. (Handling material with readings greater than 200 mR/hr typically requires special consideration.) Additionally, the presence of significant inventories of radioisotopes at these release sites, as compared to DOE STD-1027-92 (1992) facility hazard categorization guidelines, may also require that intrusive activities at the tank farm be evaluated in light of the facility nuclear safety basis. Although detailed design and final safety analysis and approval would not be required until the remedial design phase, a preliminary assessment of worker protection issues will be performed prior to development of the feasibility study to support the evaluation of cost, implementability, and short-term effectiveness.

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b. Spence, R. D., 2001, "Review and Critique of the OU 7-13/14 Draft Feasibility Study and Engineering Design Files," comments provided to BBWI Operational Review Board, October 31, 2001.

To produce a conceptual design and develop a cost estimate for stabilization, retrieval, and disposal alternatives in the feasibility study, a preliminary safety assessment will be performed. The assessment will include a preliminary evaluation of risks associated with grouting, retrieval, packaging, and transportation process, including accidents resulting from natural phenomena and external hazards to the public, the workers, and the environment. Results of the evaluation of accident scenarios will show whether significant risk to workers or the public from the operations exist and will be a basis for deciding what level of engineering controls is appropriate to include in the conceptual design and subsequent feasibility study analysis.

The methodology for the preliminary safety assessment involves the identification and screening of common as well as operational specific hazards. The significance of each hazard is evaluated based on its potential for a release of hazardous material. All hazards that are qualitatively determined to be significant in terms of the potential for an unmitigated release are further considered for possible scenarios of release and are then re-evaluated for significance assuming that existing or planned preventive and mitigative measures are in place. High-ranking hazards may be analyzed quantitatively in an accident consequence assessment. In the quantitative assessment, potential doses (and chemical exposures if applicable) to individuals at differing locations (on-Site workers, off-Site public, etc.) would be calculated for a variety of scenarios that span the range of probable occurrences.

Results of the analysis will show whether unmitigated hazards have the potential to exceed dose evaluation guidelines such as those established in DOE-ID O 420.D, "Requirements and Guidance for Safety Analysis." Depending on the outcome, the retrieval operation could be subject to design and operational requirements of 10 CFR 830, "Nuclear Safety," and DOE O 420.1, "Facility Safety." Depending on how postulated accident consequences compare to the guidelines, important safety components may be identified, including safety-significant systems, structures, and components, to mitigate unacceptable high exposures to workers. Technical safety requirements and other required administrative controls may be identified during the hazard analysis process as well. In addition to nuclear safety issues, the preliminary safety assessment will also address radiological worker protection issues and identify key protective systems that may be required to ensure compliance with 10 CFR 835, "Occupational Radiation Protection."

The results of the preliminary safety assessment will provide a basis for selecting an appropriate conceptual design for retrieval and help to determine whether nuclear facility safety requirements and quality standards would be applicable to this operation. This level of design and cost-estimate information will be necessary to support the detailed analysis of alternatives.

6.6 Remedial Alternatives Development and Screening

The OU 3-14 feasibility study will define RAOs based on results of the BRA, as discussed previously in Section 6.4, and identify and analyze alternatives to meet RAOs at OU 3-14 release sites. The overall process to be used to define RAOs and identify, screen, and analyze remedial alternatives for OU 3-14 is described below.

6.6.1 Establish Remedial Action Objectives and General Response Actions

RAOs specify the contaminants, media, exposure routes, receptors, and an acceptable contaminant level or range required to protect human health and the environment and meet ARARs. The RAOs will be based on the results of an initial analysis of ARARs and a thorough evaluation of risks determined in the BRA. The OU 3-14 RAOs will focus on protecting human health and the environment by reducing contaminant concentrations, controlling contaminant release mechanisms, or eliminating exposure pathways.

GRAs will be developed to satisfy the RAOs. GRAs for OU 3-14 include no action, institutional controls, containment, in situ treatment, ex situ treatment, excavation, and disposal. Like RAOs, GRAs are media-specific. GRAs that might be used at specific release sites are initially defined during scoping and are refined throughout the RI/FS as site conditions become better understood and action-specific ARARs are identified.

6.6.2 Preliminary Remedial Process Options

The FS process will include screening of appropriate process options available to address residual contamination that poses unacceptable risks at OU 3-14. Process options are defined for various technology types. The process options are grouped and discussed under the GRAs identified previously and discussed below.

Institutional Controls—Institutional controls include actions that prevent or limit access to contaminated areas through the period of time that DOE controls INTEC. Institutional controls also may extend beyond the period in which DOE maintains control at INTEC; however, another agency such as the Bureau of Land Management may take over the administration of institutional controls. Institutional controls may include monitoring, access restriction (fences or other barriers, signs, and security), soil-moisture management, administrative procedures, and deed restrictions. Past INEEL remedial action decisions that employ only institutional controls are referred to as limited action decisions.

Containment—Containment, often the preferred method of dealing with sites where treatment is impractical, may reduce the risk to acceptable levels without removing contaminants from the site. Containment includes process options such as capping, grout curtains, or sheet pilings designed to isolate contaminants and prevent their migration beyond the containment boundaries. Experience and data collected from other contaminated sites will help guide the development and evaluation of alternatives that include the GRA of containment.

In Situ Treatment—In situ treatment process options include treatment technologies such as grouting. The in situ treatment options would be integrated into alternatives that focus on reducing the toxicity, mobility, or volume of contaminants without removal.

Excavation—Soil retrieval options include conventional excavation equipment, e.g., trackhoes and backhoes, to less conventional equipment, including microtunneling devices and remote excavators. The Pit 9 Glovebox Excavator and other INEEL projects, as well as other DOE and industry experience, will be used to identify specific process options.

Ex Situ Treatment—Ex situ treatment process options require removing contaminants from their current location and treating them to reduce their toxicity, mobility, or volume. Ex situ treatment options could include processes such as soil washing, physical separation, and ex situ vitrification or grouting. Treated materials can either be returned to their original location or transported to a disposal location.

Disposal On- or Off-Site—This GRA includes process options for removing contaminated media from the tank farm. Once removed, materials would be packaged and transported for disposal in an engineered facility located either on or off the INEEL Site, possibly after the appropriate ex situ treatment.

6.6.3 Screening of Process Options

The preliminary list of process options supporting the selected GRAs for OU 3-14 will be screened to eliminate clearly unsuitable process options. This process option screening will be based on effectiveness, implementability, and cost.

Specific process options will be evaluated with regard to their effectiveness in achieving the RAOs. This evaluation of effectiveness will focus on the following:

- The potential effectiveness of process options in handling the estimated volumes of contaminants in specific environmental media and meeting the remediation goals identified in the RAOs

- The potential impacts to human health and the environment during the construction and implementation phase

- The reliability of the process with respect to remediation of the contaminants and site conditions.

Implementability encompasses both the technical and administrative feasibility of implementing a process option. Technical implementability is used as an initial screen of process options to eliminate those that are clearly ineffective or unworkable at a site. Administrative aspects of implementability are evaluated primarily during the detailed analysis of alternatives. However, factors such as the availability and capacity of treatment, storage, and disposal services are considered. Availability of necessary equipment and skilled workers to implement the process option are also considered.

Cost is a factor in the screening of process options. Relative capital and operating and maintenance costs are used rather than detailed estimates. At this stage of process option screening, cost analysis is based on engineering judgment and past experience, and the cost (high, low, or medium) of each process is evaluated relative to other process options of the same technology type.

Elimination of any process option during screening will be fully documented in the final feasibility study report.

6.6.4 Development of Alternatives

Alternatives will be developed that protect human health and the environment by eliminating, reducing, or controlling risks posed by the site. GRAs and the process options chosen to represent the various technology types are combined to form alternatives for the tank farm soils. The GRA of no action would be considered a baseline against which all other alternatives would be compared.

Each remedial alternative formulated in the feasibility study will specifically address each release site at the tank farm and will cumulatively address all risks for the Tank Farm Group. The design level required for feasibility study remedial alternatives is established somewhat qualitatively, with the overall goal of producing a defensible feasibility study that can (1) adequately compare alternatives and produce a cost estimate within the -30 to +50% range cited in CERCLA guidance and (2) ultimately allow for selection of a remedial alternative. To accomplish this, a design level between conceptual and preliminary should be produced for each alternative passing initial screening.

6.6.5 Screening of Alternatives

Alternatives will be screened on the basis of the short- and long-term aspects of their effectiveness, implementability, and cost. Each screening criterion is discussed below. To the extent practical, a wide range of alternatives will be preserved. Computerized decision analysis tools may be used to document the screening and analysis of alternatives and to facilitate agreement among the multiple parties who will use the results of the feasibility study to select a preferred remedial alternative.

6.6.5.1 Effectiveness. A key aspect of the screening evaluation is the effectiveness of each alternative in protecting human health and the environment. Each alternative developed will be evaluated for effectiveness in providing protection and reduction of toxicity, mobility, or volume. Both short- and long-term components of effectiveness will be evaluated. Short-term effectiveness refers to the period until the remedial action is complete. Long-term effectiveness refers to controls that may be required to manage the risk posed by treatment residuals, untreated water, and any contamination left at the site. Reduction of toxicity, mobility, or volume refers to changes in one or more characteristics of the radiological or chemical compounds or contaminated media resulting from a treatment that decreases the inherent threats or risks associated with the contamination. Results of treatability studies discussed in Sections 5.2.3.5 and 6.5 for specific technologies will be included in this evaluation.

6.6.5.2 Implementability. Implementability is a measure of both the technical and administrative feasibility of constructing, operating, and maintaining a remedial action alternative. Technical feasibility is the ability to construct, reliably operate, and meet technology-specific regulations for process options. Administrative feasibility refers to the ability to obtain approvals from DOE Idaho, EPA, and IDEQ; availability of treatment, storage, and disposal services (and capacity); and requirements for and availability of specific equipment and technical specialists.

6.6.5.3 Cost. A cost estimate for each alternative will be prepared. Cost estimates at this level of evaluation are typically not accurate at the level desired for the detailed analysis, i.e., +50 to -30%. Parametric estimates or vendor information are often used at this level of estimate. However, cost-sensitive parameters for each process option should be identified and receive the most attention. These data needs are discussed in Sections 5.2.3 and 6.5 for specific technologies.

Capital and operations and maintenance costs will be considered, where appropriate, during the screening of alternatives. The evaluation will include those operating and maintenance costs that will be incurred for as long as necessary, even after the initial remedial action is complete. In addition, potential future remedial action costs will be considered during alternative screening to the extent that they can be defined. Present worth analyses will be used during alternative screening to evaluate expenditures that occur over different periods.

6.6.5.4 Selection of Alternatives for Detailed Analysis. The output of the alternatives-screening step is a list of candidate alternatives that can reduce risk to human health and the environment and that are technically and administratively feasible. To the extent possible, the range of alternatives originally defined, i.e., no action through limited action and more intensive actions, will be preserved.

The results of the screening process will be reviewed by DOE, EPA, and IDEQ. This review will result in an agreed-upon set of alternatives that will undergo detailed analysis.

6.7 Detailed Analysis of Alternatives

Alternatives remaining after the screening process will first be analyzed in detail individually and then in comparison to each other. A No Action alternative will also be analyzed and serve as a baseline against which all other alternatives are compared. The detailed analysis will consist of an assessment of individual alternatives compared to the nine evaluation criteria discussed below. A comparative analysis will then focus on the relative performance of each alternative against the criteria.

The nine evaluation criteria discussed below are categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. The first two criteria, overall protection of human health and the environment and compliance with ARARs, are the threshold criteria that must be met in order for an alternative to be eligible for selection. The third to seventh criteria are the primary balancing criteria that compare the relative tradeoffs among the alternatives. The last two criteria are the modifying criteria and will be addressed in the ROD after public comment on the comprehensive RI/FS report and Proposed Plan.

6.7.1 Overall Protection of Human Health and the Environment

Alternatives will be assessed to determine whether they can adequately protect human health and the environment by eliminating, reducing, or controlling risks.

6.7.2 Compliance with ARARs

The alternatives will be assessed to determine whether they meet ARARs. The feasibility study will acknowledge those alternatives that would require an ARARs waiver under 40 CFR 300.430 (f)(1)(ii)(C) to be the proposed remedial alternative.

6.7.3 Long-Term Effectiveness and Permanence

Alternatives will be assessed to determine the long-term effectiveness and permanence that they afford, along with the degree of certainty that each alternative will prove successful. Factors affecting long-term permanence and effectiveness include the following:

- A residual risk assessment for each alternative to evaluate the risks associated with the implementation of the remedial alternative
- The type, degree, and adequacy of long-term management required, including engineering controls, institutional controls, monitoring, operation, and maintenance
- Long-term reliability of controls, including uncertainties associated with land disposal of untreated hazardous waste and treatment residuals
- The potential need for replacement of the remedy.

6.7.4 Reduction of Toxicity, Mobility, and Volume

The degree to which alternatives employ treatments that reduce toxicity, mobility, or volume will be assessed. Results of treatability studies discussed in Sections 5.2.3 and 6.5 for specific technologies should be included in this evaluation. Factors affecting toxicity, mobility, or volume that will be considered include the following:

- The type of process options employed in an alternative and what materials they will treat
- Amount of contamination that will be destroyed or treated
- The degree of expected reduction in toxicity, mobility, or volume
- The degree to which the treatment is irreversible
- Residuals that will remain and by-products that will be created following treatment.

6.7.5 Short-Term Effectiveness

Assessment of short-term effectiveness of alternatives will consider the following:

- Possible short-term risks to the community during implementation of an alternative
- Potential impacts on workers conducting remedial actions and the effectiveness and reliability of protective measures
- Potential environmental impacts of remedial actions and the effectiveness and reliability of mitigative measures during implementation
- The time until protection is achieved.

6.7.6 Implementability

Assessment of the ease or difficulty of implementing the alternatives will consider the following:

- Degree of difficulty or uncertainty associated with construction and operation of the technology
- Expected operational reliability and the ability to undertake additional action, if required
- Ability and time required to obtain necessary approvals and permits from the Agencies
- Availability of necessary equipment and specialists
- Available capacity and location of needed treatment, storage, and disposal services
- Timing of the availability of prospective technologies that may be under development.

6.7.7 Costs

Costs will be estimated, including capital and operation and maintenance costs based on present value. The costs will be developed with an accuracy of +50 to -30% (EPA 1988a), unless otherwise stated in the feasibility study.

6.7.8 State of Idaho Acceptance

Concerns identified by the IDEQ during its reviews of the comprehensive RI/FS Work Plan, RI/FS, Proposed Plan, and ROD will be assessed. The reviews will consider the proposed use of waivers, the selection process used to evaluate alternatives, and other actions. Comments received from the State of Idaho will be incorporated into the remedial evaluation.

6.7.9 Community Acceptance

Community response to the alternatives will be assessed. Similar to the IDEQ acceptance criteria, complete assessment will not be possible until comments on the proposed action have been received. The process for public involvement is discussed in detail in Section 6.9.

6.8 Remedial Investigation/Feasibility Study Report

A draft RI/FS report will summarize previous field investigation results, treatability studies, ARAR analyses, comprehensive and cumulative risk assessments, and remedial alternatives. The RI/FS report is defined as a primary document in the FFA/CO Action Plan (DOE-ID 1991). The RI/FS report will serve as a basis for consolidating information that has been obtained and will document the rationale used to screen and develop remedial actions for OU 3-14. The RI/FS report will contain information that the decision-makers need to select an appropriate remedy for OU 3-14. The elements of the RI/FS report will follow the basic format presented in EPA (1988a). Supporting data, information, and calculations will be included in the appendices to the RI/FS report. The report will be revised in accordance with comments received and submitted to DOE Idaho, EPA, and IDEQ for review. Written comments on the draft RI/FS from EPA and IDEQ will be addressed in the final RI/FS report.

6.9 Proposed Plan and Record of Decision

The OU 3-14 RI/FS activities include preparation of a Proposed Plan and ROD. The Proposed Plan, a secondary document, as defined in the FFA/CO Action Plan (DOE-ID 1991), will be prepared to facilitate public participation in the remedy selection process. After the RI/FS report is complete, the Proposed Plan for OU 3-14 will be presented to the public. This plan will outline the proposed remediation plans developed and supported by the RI/FS activities. The Proposed Plan will be written in accordance with the format recommended in EPA guidance (EPA 1999). Any issues raised during the public comment period will be addressed in the ROD responsiveness summary.

Public involvement in the decision process is vital to the successful implementation of a remedial alternative. Public participation in the decision process will be conducted according to the Community Relations Plan (INEL 1995) and EPA guidance (EPA 2002b).

After DOE Idaho, EPA, IDEQ, and public comments on the RI/FS report and Proposed Plan are received, a remedy for OU 3-14 will be selected and documented in the ROD, which will be signed by the parties specified in the FFA/CO. The ROD will be prepared in accordance with EPA guidance (EPA 1999). The ROD will serve the following four functions:

- Certify that the remedy selection process was carried out in accordance with the FFA/CO (DOE-ID 1991) and, to the extent practicable, with the NCP (40 CFR 300)
- Describe the technical parameters of the remedy, specifying the treatment, engineering, and institutional components as well as remediation goals
- Provide the public with a consolidated source of information about the site and the chosen remedy, including the rationale behind the selection
- Delineate post-ROD activities, such as scoping the remediation, remedial action plan development, and monitoring.

6.10 Identification of Potentially Applicable or Relevant and Appropriate Requirements (ARARs)

This section identifies initial ARARs for OU 3-14. The list represents a preliminary identification of ARARs based on site characteristics and knowledge of contaminants. Further identification and definition of ARARs will be conducted through a phased process as remedial action alternatives appropriate for the site are identified and will be presented in the OU 3-14 RI/FS, Proposed Plan, and ROD.

CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (42 USC § 9601), requires the selection of remedial actions that satisfy two threshold criteria: overall protection of human health and the environment and compliance with ARARs. Remedies must address substantive standards, requirements, criteria, or limitations under federal environmental laws and any promulgated state environmental requirements, standards, criteria, or limitations that are more stringent than corresponding federal standards. In addition, the importance of nonpromulgated criteria or other advisory information, called "to be considered" or TBC criteria, is formally recognized in the NCP in the development of remediation goals or cleanup levels.

The EPA has specified that potential ARARs identified for a site should be considered at several points in the remediation planning process (EPA 1988a). These points include the following:

- During scoping of the RI/FS, chemical- and location-specific ARARs may be identified on a preliminary basis.
- During the site characterization phase of the remedial investigation, when the baseline public health evaluation is conducted to assess risk at a given site, chemical-specific ARARs and TBC criteria are identified more comprehensively and are used to help identify preliminary RAOs.
- During the feasibility study, location- and action-specific ARARs are identified for each alternative evaluated in the detailed analysis of alternatives. Changes in regulatory requirements can be assessed through the development of the ROD.

The ARAR identification process for the OU 3-14 comprehensive investigation consists of evaluating sites against the *CERCLA Compliance with Other Laws Manual* (EPA 1988b) to identify preliminary chemical- and location-specific ARARs. Generally, action-specific ARARs are identified in the feasibility study, as appropriate for the remedial alternatives under consideration. However, if an action-specific ARAR contains generic requirements that are deemed appropriate in most remedial scenarios likely to be employed at OU 3-14, it is identified below.

6.10.1 Preliminary ARARs Identification for OU 3-14 Tank Farm Soils

This section and Section 6.10.2 discuss the preliminary list of ARARs that may apply to OU 3-14 tank farm soils. Section 6.10.2 presents a preliminary list of TBC criteria that may apply to remedial actions under OU 3-14. Tables 6-1 and 6-2 present preliminary lists of potential ARARs and TBC guidance, respectively. This list identifies ARARs that may apply to CERCLA sites located within an operational facility, have been extensively disturbed from construction activities, and have ongoing work activities in the vicinity.

6.10.1.1 Action-Specific ARARs. Action-specific ARARs are technology- or activity-based requirements for actions taken at a site. Action-specific ARARs generally do not guide the development of remedial action alternatives, but these ARARs indicate how the selected remedy must be implemented. Action-specific ARARs will be refined following alternative development.

Principal action-specific ARARs relate to radioactive material and well construction requirement standards, the management of storm water and fugitive dust emissions, and management and disposal of radioactive or hazardous waste or residuals, and capping of waste in place.

6.10.1.2 Chemical-Specific ARARs. Chemical-specific ARARs are usually health- or risk-based values that establish the acceptable amounts or concentrations of a chemical that may be found in or discharged to the ambient environment.

Within the context of the effectiveness evaluation, chemical-specific ARARs assume significance, as each alternative is evaluated for its effectiveness in protecting human health and the environment.

Table 6-1. Preliminary list of ARARs for tank farm soil and groundwater.

Statute or Requirement	Citation	Applicable (A), or Relevant and Appropriate (R&A)	Comments
Action-specific			
Remediation Waste Staging Piles	IDAPA 58.01.05.008 (40 CFR 264.554)	A	Applies to management of CERCLA wastes that may be generated and require staging prior to transport to the ICDF or an off-Site facility.
Temporary Units	IDAPA 58.01.05.008 (40 CFR 264.553)	A	Applies to temporary management of CERCLA wastes that may be generated and require storage (<1 yr) before transport to the ICDF or an off-Site facility.
Procedures for Planning and Implementing Off-Site Response Actions	40 CFR 300.440	A	Applies to CERCLA wastes that are sent off-Site for storage, treatment, or disposal.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal facilities	IDAPA 58.01.05.008 (40 CFR 264)	A	Applies to waste treatment performed as part of the remedial action. Specific sections of this ARAR will be reviewed for applicability to feasibility study treatment options.
Closure and Post-Closure Requirements	IDAPA 16.01.05.008 [40 CFR Subpart G]	A	Applies to soils that are capped in place with an engineered barrier.
Land Disposal Restrictions	IDAPA 58.01.05.011 (40 CFR 268)	A	Applies to CERCLA wastes that would otherwise be a RCRA hazardous waste. If these wastes are shipped off-Site for disposal. Also applies to soils that have triggered placement.
Alternative Land Disposal Restriction Treatment Standards for Contaminated Soils	IDAPA 58.01.05.011 (40 CFR 268.49)	A	Applies to CERCLA soils that would otherwise be a RCRA hazardous waste. If these wastes are shipped off-Site for disposal. Also applies to soils that have triggered placement.
Idaho Well Construction Standards	IDAPA 37.03.09.025	A	Applies to drilling of new groundwater monitoring wells, if required.
Chemical-specific			
Hazardous Waste Determination	IDAPA 58.01.05.006 (40 CFR 262.11)	A	Applies to waste generated during remediation activities.
Hazardous Waste Characteristics Identification	IDAPA 58.01.05.005 (40 CFR 261.20 through .24)	A	Applies if soils are excavated and consolidated to facilitate their management or treated or placed in long-term storage awaiting disposal.

Table 6-1. (continued).

Statute or Requirement	Citation	Applicable (A), or Relevant and Appropriate (R&A)	Comments
Idaho Fugitive Dust Emissions	IDAPA 58.01.01.650 et seq.	A	Applies to control of dust during site disturbance and well drilling activities.
Rules for the Control of Air Pollution in Idaho (Air Toxics Rules)	IDAPA 58.01.01.585 and 58.01.01.586	A	Applies to control of emissions during site disturbance and well drilling activities.
Idaho Ground Water Quality Rule	IDAPA 58.01.11.200	A	Applies to groundwater standards.
National Emission Standards for Hazardous Air Pollutants (NESHAPS)	40 CFR 61.92 40 CFR 61.93	A	Applies to control of radionuclide emissions during earthmoving and well drilling activities.
Location-specific			
Floodplains	10 CFR 1022[40 CFR 270 and 265; 40 CFR 6, Appendix A (Executive Order 11988)]	A	Applies to activities conducted in the 100-yr floodplain. Fill material or structures would be evaluated to ensure that they are able to withstand the 100-yr flood flows.
National Historic Preservation Act	16 USC 470 et seq.	A	An assessment will be performed to determine if the aboveground structures are eligible for designation under the National Historic Preservation Act. If eligible, appropriate follow-on actions would be performed.

Table 6-2. Preliminary list of TBC environmental criteria for OU 3-14.

TBC Criteria	Title
DOE Order 5480.4	Environmental Protection, Safety, and Health Protection Standards
DOE Order 435.1	Radioactive Waste Management
DOE Order 231.1	Environment, Safety and Health Reporting
DOE Order 5400.5	Radiation Protection of the Public and Environment

The ability to protect human health and the environment is a threshold criterion that CERCLA remedial actions must meet to be considered a preferred remedy. The EPA considers a remedy protective if it “adequately eliminates, reduces, or controls all current and potential risks posed through each [exposure] pathway [at] the site.” In accomplishing protectiveness, a remediation alternative must meet or exceed ARARs or other risk-based levels established when ARARs do not exist or are waived.

In both the NCP and the *CERCLA Compliance with Other Laws Manual* (EPA 1988b), the EPA specifies that when ARARs are not available for a given chemical or when such chemical-specific ARARs are not sufficient to be protective, risk-based levels should be identified or developed to ensure that a remedy is protective. Both carcinogenic and noncarcinogenic effects are considered in determining risk-based levels and evaluating protectiveness. For carcinogenic effects, the health advisory or risk-based levels are selected so that the total lifetime risk to the exposed population of all contaminants falls within the acceptable range of 10^{-4} to 10^{-6}. The 10^{-6} risk level is specified by EPA as a point of departure for levels of exposure, as determined by EPA reference doses, taking into account the effects of other contaminants at the site.

Therefore, chemical-specific ARARs serve three primary purposes:

- To identify requirements that must be met as a minimum by a selected remedial action alternative (unless a waiver is obtained).

- To provide a basis for establishing appropriate cleanup levels.

- To identify chemical-specific ARARs for contaminants at OU 3-14. The National Emission Standards for Hazardous Air Pollutants (40 CFR 61.92) established emission limits for radionuclides other than radon from DOE facilities. The standard limits an entire facility's emissions to ambient air to an amount that would not cause any member of the public to receive an effective dose equivalent of 10 mrem per year. These requirements are considered potentially applicable to possible remedial actions that may be undertaken at OU 3-14.

The State of Idaho's rule governing new sources of toxic air pollutants, located in IDAPA 58.01.01.585 and 58.01.01.586, is a potential ARAR if a remedial option generates regulated toxic air pollutants. If toxic air pollutant emissions exceed relevant screening levels, appropriate air modeling would determine ambient air concentration. Reasonable available control technologies would be employed to control emissions if acceptable ambient air concentrations were exceeded. If remedial action is necessary, air-screening analysis would determine the levels of emissions likely to be associated with the options being proposed. The INEEL is categorized as an attainment or unclassified area for ambient air quality (42 USC 7401 et seq.) and, therefore, is subject to IDAPA 58.01.01.575-77 and 40 CFR 50.

6.10.1.3 Location-Specific ARARs. Location-specific ARARs are regulatory requirements or restrictions on activities in specific locations that a given remedial action must meet. General location-specific regulatory requirements are identified in Table 6-1.

6.10.2 To-Be-Considered Guidance

TBC criteria are advisories, guidelines, or policies that do not meet the definition of ARARs. These criteria may assist in determining protective criteria in the absence of specific ARARs. Preliminary TBC criteria for the OU 3-14 site include the following:

- DOE orders and manuals

- Executive orders

- Federal and state rules pertaining to relevant subjects that are not promulgated criteria, limits, or standards by definition of Section 121[d] of CERCLA (42 USC 9601)

- EPA guidance documents
- Remedial action decisions at similar Superfund sites.

Table 6-2 lists potential TBC criteria for OU 3-14.

7. SCHEDULE

This section provides a detailed schedule showing the working schedule, major project deliverables, and critical-path activities for the OU 3-14 project (Figure 7-1).

7.1 OU 3-14 RI/FS Activities

A diagram showing the major RI/FS activities and the logic for completing them is presented in Figure 7-2. The following are brief descriptions of the major OU 3-14 RI/FS activities. Table 7-1 presents scheduled completion dates for these activities.

- RI/FS Work Plan—This Work Plan delineates the history associated with the OU 3-14 site and presents a high-level path forward to site characterization, risk assessment, modeling, and potential remedial actions. Included within this Work Plan are the tank farm soil FSP (Appendix A), the HASP (Appendix B), and the waste management plan (Appendix C) to implement characterization activities.

- Phase I (remedial investigation) data collection—This activity will implement data-gathering activities associated with the tank farm soil as identified in this Work Plan.

- Phase II (feasibility study) data collection—This activity will implement the second phase of data collection. The objective of the Phase II field effort is to define the composition of radiological contamination.

- Contaminant transport study and report—This activity encompasses gathering parameters such as acid demand, K_d values, and the leachability of contaminants in tank farm soil.

- Treatability studies (if necessary).

- RI/BRA report—The RI/BRA report will include the screening of all contaminants and calculations of exposures for the tank farm soil contaminants. The report will also establish the tank farm COCs that will be used in the feasibility study evaluations.

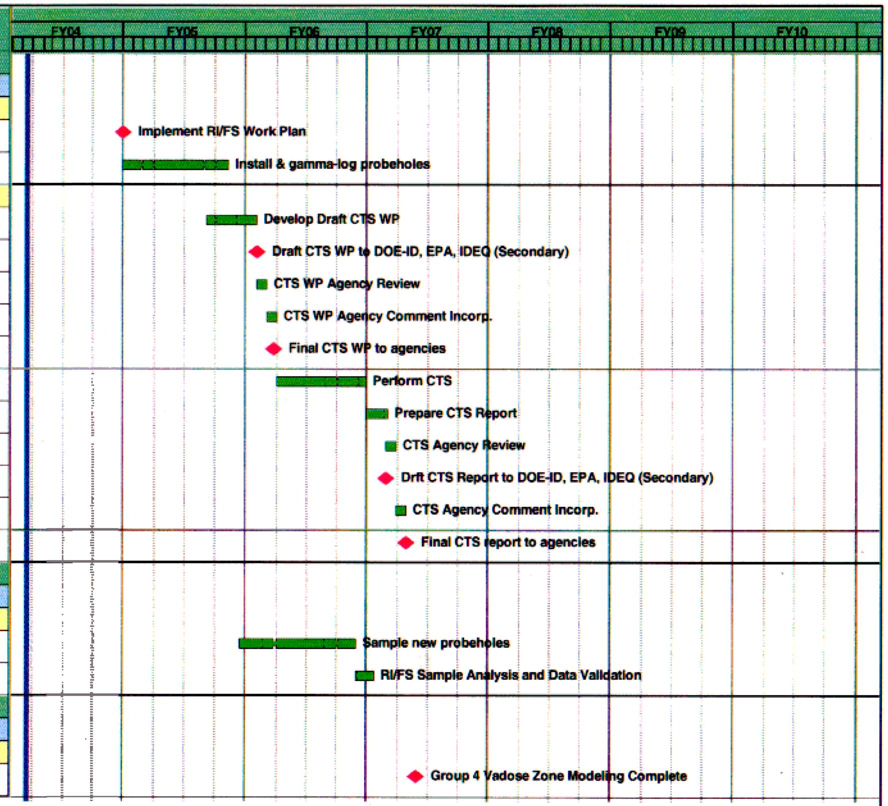
- RI/FS report—The RI/FS report will complete screening of the technology alternatives and evaluate the remaining remedial technology alternatives using the information gathered during Phase I and II characterization. The detailed evaluations will use seven of the nine CERCLA evaluation criteria.

- National Remedy Review Board—Due to the size, complexity, and cost (>$75 million) of the remedies selected for OU 3-14, the project is expected to undergo an EPA National Remedy Review Board meeting.

- Proposed Plan—The Proposed Plan is a summary of the RI/BRA and RI/FS reports, with a preferred remedy recommended for both the tank farm soil and the injection well issues.

- Public comment period—The public will be presented with the Proposed Plan, and a formal public comment period will be initiated along with public meetings on the Proposed Plan.

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
RI/FS Work Plan/FSP				
RI Data Collection				
125	Implement RI/FS Work Plan	0	01OCT04*	
150	Install & gamma-log probeholes	217	01OCT04	12AUG05
Contaminant Transport (Kd) Studies (CTS)				
240	Develop Draft CTS WP	103	09JUN05	02NOV05
275	Draft CTS WP to DOE-ID, EPA, IDEQ (Secondary)	0		02NOV05
277	CTS WP Agency Review	30	03NOV05	02DEC05
279	CTS WP Agency Comment Incorp.	30	03DEC05	01JAN06
280	Final CTS WP to agencies	0		23DEC05
290	Perform CTS	188	03JAN06	27SEP06
300	Prepare CTS Report	45	28SEP06	01DEC06
325	CTS Agency Review	30	01DEC06	30DEC06
332	Drft CTS Report to DOE-ID, EPA, IDEQ (Secondary)	0	01DEC06*	
327	CTS Agency Comment Incorp.	30	31DEC06	29JAN07
340	Final CTS report to agencies	0		29JAN07
RI/Feasibility Study Data Collection				
370	Sample new probeholes	237	16SEP05	28AUG06
380	RI/FS Sample Analysis and Data Validation	40	29AUG06	24OCT06
Baseline Risk Assessment (BRA)				
390	Group 4 Vadose Zone Modeling Complete	0		28FEB07*



Start Date	01OCT03
Finish Date	25SEP10
Data Date	15DEC03
Run Date	27MAY04 12:59

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Early Bar
Progress Bar

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Sheet 1 of 3

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OU 3-14 Tank Farm

Figure 7-1. Schedule of major project and critical path activities for the OU 3-14.

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
400	Develop Draft RI/BRA Report	120	01MAR07	17AUG07
410	Draft RI/BRA Rpt. to DOE-ID, EPA,IDEQ(Secondary)	0		17AUG07
420	EPA & IDEQ Review draft RI/BRA Report	30	18AUG07	16SEP07
425	Incorporate EPA & IDEQ Comments	30	17SEP07	16OCT07
430	Final RI/BRA Report	0		16OCT07
Tank Farm Soils Treatability Study Work Plan				
440	DevelopTreatability Study Work Plan	40	20AUG07	15OCT07
450	Submit Draft TFS TS Work Plan to Agencies (Sec.)	0		15OCT07
460	EPA and IDEQ Review draft TFS TS Work Plan	30	16OCT07	14NOV07
470	Incorporate EPA and IDEQ Comments	30	15NOV07	14DEC07
480	Submit Final TFS TS Work Plan to EPA and IDEQ	0		14DEC07
490	Conduct TFS Treatability Study	122	17DEC07	12JUN08
RI/FS Report				
500	Prepare RI/FS Report	120	13JUN08	03DEC08
510	Draft RI/FS Rpt.to DOE-ID, EPA, IDEQ (Primary)	0		03DEC08
520	Review RI/FS Report	120	04DEC08	02APR09
530	Final RI/FS Report	0		02APR09
EPA National Remedy Review Board (NRRB)				
540	Develop NRRB Briefing Package	22	28JAN09	26FEB09
550	Draft NRRB Presentation to EPA (Other)	0		26FEB09
560	Review NRRB Briefing Package	88	27FEB09	01JUL09
570	Conduct NRRB Meeting	99	02JUL09	19NOV09

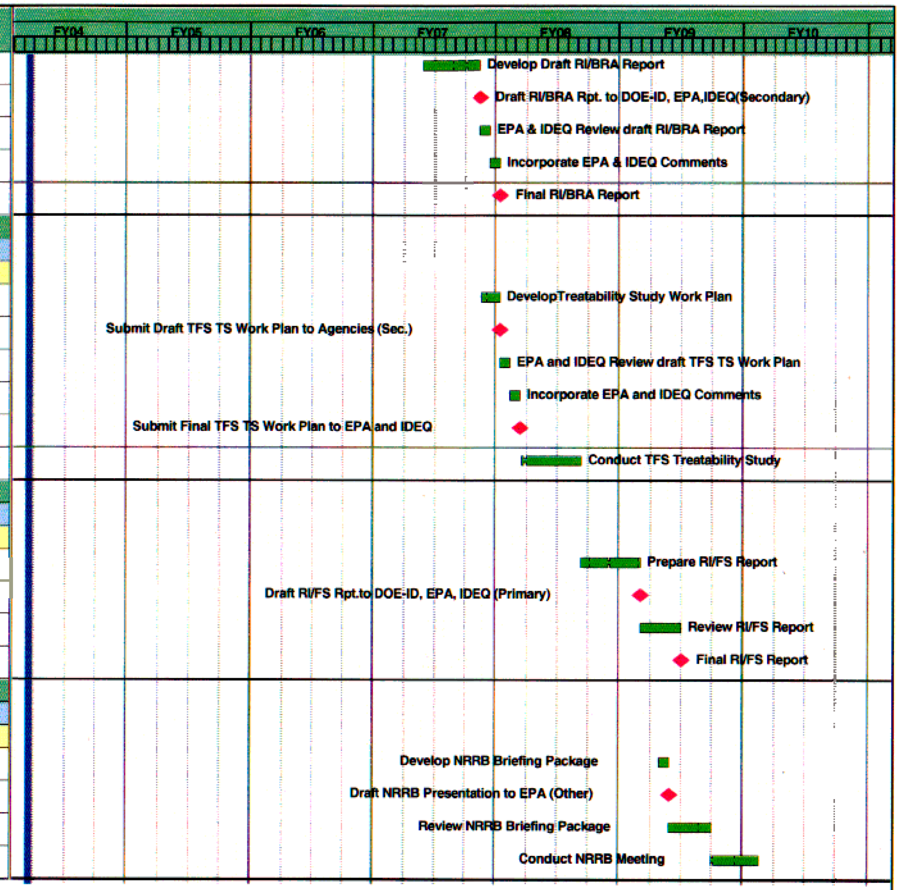

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Figure 7-1. (continued).

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
Proposed Plan				
580	Prepare Proposed Plan	88	30APR09	02SEP09
590	Drft Proposed Plan to Agencies (Secondary)	0		02SEP09
600	Review Proposed Plan	60	03SEP09	01NOV09
610	Proposed Plan Public Comment Period	60	02NOV09	31DEC09
620	Final Proposed Plan	0		31DEC09
Record of Decision				
700	Prepare Record of Decision	141	02NOV09	27MAY10
710	Drft. Record of Decision to Agencies (Primary)	0		28MAY10*
720	Review (ROD) Record of Decision	12(	29MAY10	25SEP10
730	Final (ROD) to Agencies	0		25SEP10

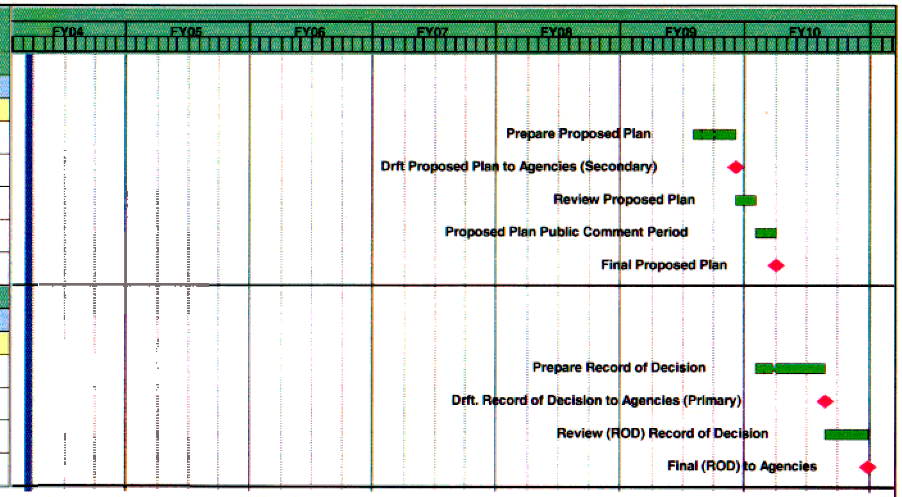

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Figure 7-1. (continued).

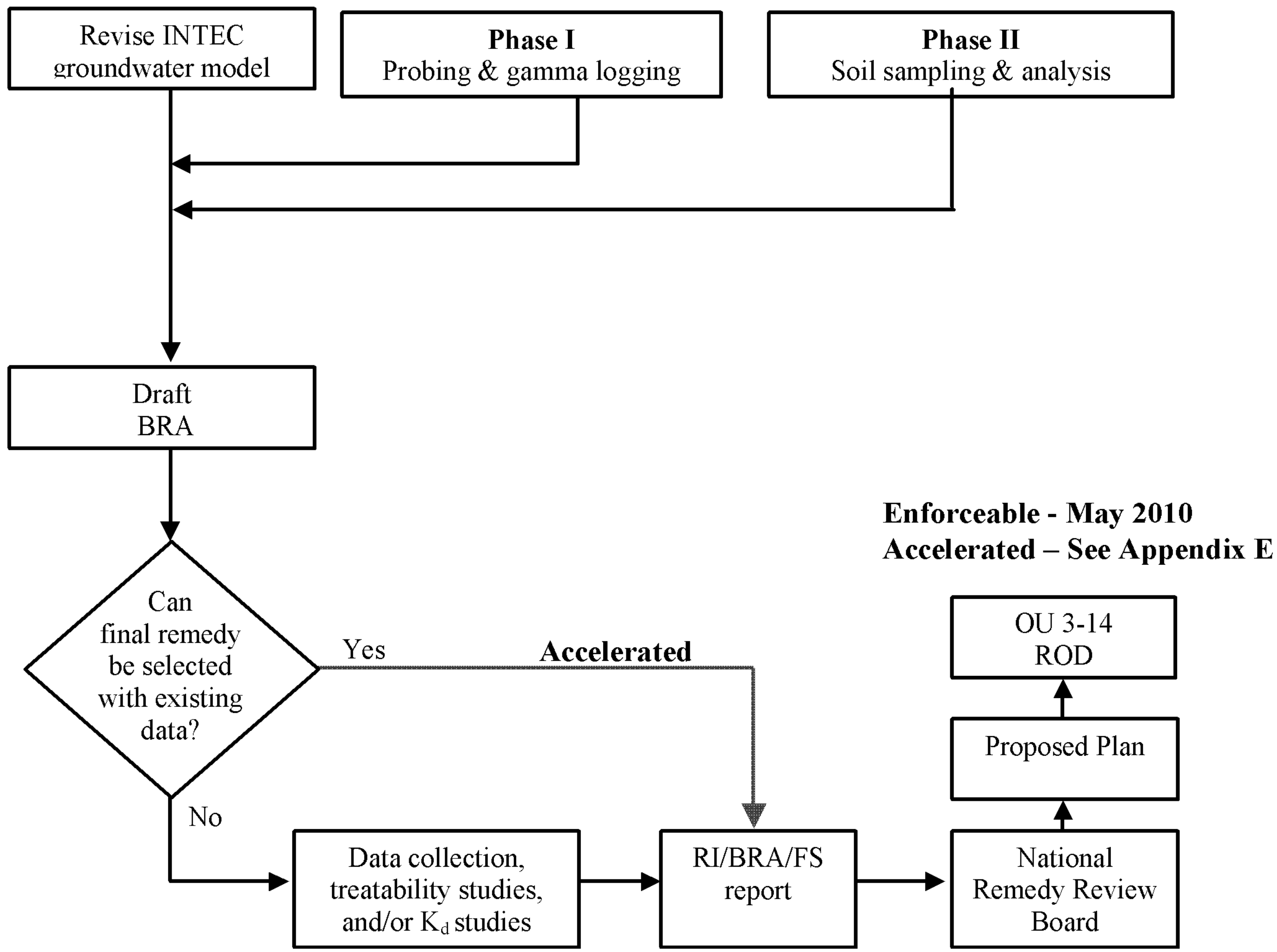

Figure 7-2. OU 3-14 RI/FS Work Plan logic.

Table 7-1. Schedule for the major OU 3-14 RI/FS documents.

Document	Document Type	Schedule
Draft contaminant transport study work plan submitted to EPA and IDEQ	Secondary	November 2, 2005
Draft contaminant transport study report submitted to EPA and IDEQ	Secondary	December 1, 2006
Draft RI/BRA report submitted to EPA and IDEQ	Secondary	August 17, 2007
Draft tank farm soils treatability study work plan to EPA and IDEQ	Secondary	October 15, 2007
Draft RI/FS report submitted to EPA and IDEQ	**Primary**	**December 3, 2008**
EPA National Remedy Review Board briefing package and presentation submitted to EPA	Other	February 26, 2009
Draft Proposed Plan submitted to EPA and IDEQ	Secondary	September 2, 2009
Draft OU 3-14 ROD submitted to EPA and IDEQ	**Primary**	**May 28, 2010**

- ROD—The ROD, including the responsiveness summary, will be the document that describes the remedy selected for implementation during OU 3-14 Remedial Design/Remedial Action phases and the associated site risks.

7.2 Accelerated OU 3-14 Schedule

An accelerated schedule and logic flowchart for the OU 3-14 RI/FS is presented in Appendix E. This approach has the potential of achieving an early ROD for the tank farm soils and meets the acceleration goal in the Agreement to Resolve Dispute for the Tank Farm Interim Action (DOE 2003). Key points to the accelerated schedule are described below:

- The groundwater modeling and preliminary BRA would begin after approval of the OU 3-14 RI/FS Work Plan. This effort would use available information and reasonably conservative assumptions to develop the preliminary BRA for the tank farm soils.

- The OU 3-14 data collection activities, including both the remedial investigation and feasibility study components, would begin after completion of the TFIA and be used to verify the model input and output and the preliminary BRA. This information would be compared to the reasonably conservative assumptions used in the model and the preliminary BRA, and the necessary adjustments would be made to the preliminary baseline risk assessment.

- The draft BRA report would be submitted to the Agencies for review. The report would describe the baseline risk from the tank farm soils and help to determine whether a final remedy can be selected with existing data. If enough information were available to select a remedy for the tank farm soils, then a remedial investigation, feasibility study, Proposed Plan, and ROD would be prepared to achieve an early decision for the tank farm soils. Otherwise, additional data collection or evaluation is required and would entail a revision to the OU 3-14 RI/FS Work Plan. This latter effort results in an OU 3-14 ROD in May 2010, consistent with the existing enforceable milestone in the OU 3-14 RI/FS Work Plan.

8. PROJECT MANAGEMENT PLAN

This section describes the elements of project management for the OU 3-14 RI/FS, as follows:

- Key positions and responsibilities
- Organization
- Change control
- Work performance
- Communications.

8.1 Key Positions and Responsibilities

ICP is committed to accelerating the reduction of environmental risk at the INEEL by completing the DOE's cleanup responsibility faster and more efficiently without adverse impact to the safety of workers, the environment, and the public. ICP is divided into five project divisions, each having a unique scope of work:

- Balance of INEEL Cleanup
- Eliminate Mixed Low-Level Waste Backlog
- Test Area North Clean/Close
- RWMC Clean/Close
- INTEC Clean/Close.

The INTEC Clean/Close Project directly supports the ICP's mission of risk reduction to workers, the public, the environment, and future generations by safely disposing of HLW, SBW, and SNF and remediating associated contaminated soils.

The INTEC Clean/Close Project is divided into seven subprojects. Subproject (SP) 6 has the responsibility for completing the INTEC tank farm soil investigation and remediation.

The organizational structure for SP-6 reflects the managerial and oversight resources governing the performance of work while minimizing risks to workers' health and safety, the environment, and the public. Figure 8-1 and the following sections outline the responsibilities of the key personnel.

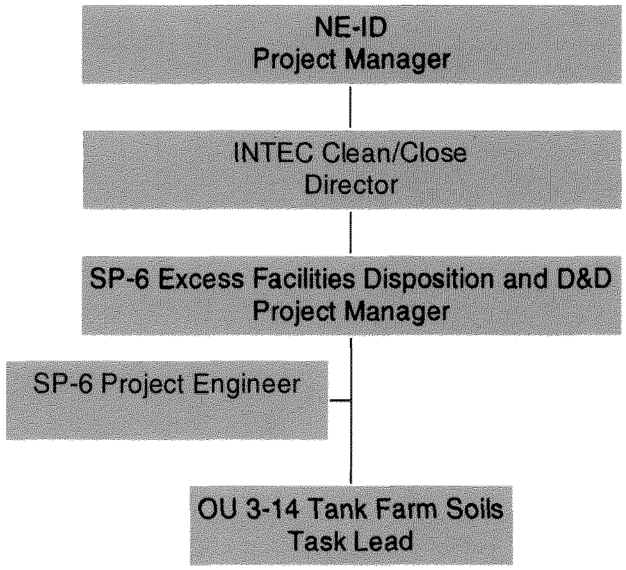

Figure 8-1. OU 3-14 tank farm RI/FS organizational structure

8.1.1 DOE Idaho OU 3-14 Remediation Project Manager

The DOE Idaho OU 3-14 remediation project manager is responsible for DOE Idaho oversight of SP-6 to ensure that (1) the contractor is operating safely and efficiently; (2) the contractor's management system is effectively controlling the conduct of operations and implementing the integrated safety management objectives, principles, and functions; (3) DOE Idaho line managers are cognizant of the operational performance of facility contractors; and (4) effective lines of communication between DOE Idaho and its operating contractors are maintained during normal operation and following reportable events in accordance with DOE orders and requirements.

8.1.2 INTEC Clean/Close Director

The INTEC Clean/Close Project director has the ultimate responsibility for the technical quality of all projects, maintaining a safe environment, and ensuring the safety and health of all personnel during field activities performed by or for the program. The director provides technical coordination and interfaces with the DOE Idaho Environmental Support Office. The director ensures the following:

- Project/program activities are conducted according to applicable federal, state, local, and company requirements and agreements.
- Program budgets and schedules are approved and monitored to be within budgetary guidelines.
- Personnel, equipment, subcontractors, and services are available.
- Direction is provided for the development of tasks, evaluation of findings, development of conclusions and recommendations, and production of reports.

8.1.3 SP-6 Manager

The INTEC Clean/Close Project SP-6 manager will ensure that all tank farm soil (OU 3-14 tank farm RI/FS) investigation activities conducted during the project comply with company management control procedures (MCPs) and program requirements documents; applicable Occupational Safety and Health Administration, EPA, DOE, Department of Transportation, and State of Idaho requirements; applicable company policies and procedures; the QAPjP (DOE-ID 2004d); the project FSP (Appendix A); and the project HASP (Appendix B). The project manager is responsible for coordination of document preparation and field, laboratory, and modeling activities. The project manager is responsible for work planning, authorization, and performance; analysis; reporting; baseline change control; and day-to-day communication with DOE Idaho. Responsibilities include the following:

- Maintaining full project staffing with personnel having appropriate qualifications, ensuring personnel are qualified to perform their jobs, and ensuring that training is up to date and in compliance with individual training plans
- Acting as the point-of-contact with other organizations, project staff members, and the contractor
- Reviewing project status and variance reports and providing direction for corrective actions
- Ensuring project performance meets expectations, including scope, schedule, and budget requirements
- Ensuring milestones and goals are met
- Maintaining focus on the "big picture" and long-term actions.

8.1.4 SP-6 Project Engineer

The project engineer is responsible to the SP-6 project manager for providing day-to-day representation for the management and coordination of the engineering activities for the project. Specific responsibilities include the following:

- Managing the technical activities for assigned work (including systems engineering, facility-engineering, engineering-specialist, and scientist activities) by supervising technical staff to ensure timely and cost-effective technical services are performed in accordance with high technical standards, sound engineering practices, good science, and customers' orders and directives
- Serving as the primary point of contact with FFA/CO Agencies
- Ensuring that field documents and planning-and-decision documents meet the appropriate technical quality requirements
- Ensuring the scope of work to be performed is clear, concise, and executable by working with the customer and the primary owner to establish firm project/task requirements
- Ensuring cost-effective technical solutions are developed in accordance with safety, environmental, and quality objectives
- Setting objectives and deadlines for implementation of actions and monitoring the quality of performance.

8.1.5 OU 3-14 RI/FS Task Lead

Specific responsibilities of the OU 3-14 RI/FS task lead include the following:

- Providing day-to-day direction to the project team
- Ensuring project performance meets expectations, including scope, schedule, and budget requirements
- Tracking trends and managing project scope, schedule, and budget on a weekly basis using a specified format
- Forming and maintaining the project team in conjunction with the SP-6 manager and SP-6 project engineer
- Ensuring that the scope of work to be performed is clear, concise, and executable by working with the customer and the primary owner to establish firm project/task requirements.

8.2 Planning

This section provides an overview of project planning, budgeting, and baselines.

8.2.1 Planning and Budgeting Overview

Planning and budgeting are the processes by which control accounts are developed, reviewed, approved, and authorized. The sum of the approved control account plans becomes the time-phased performance measurement baseline, which is the formal plan against which progress is evaluated. This section describes the parameters for project work, including the project master schedule and the Work Breakdown Structure. From these documents, the control account and its associated schedule, budget, and scope of work are defined.

The planning process requires that the full scope of work be planned and scheduled. Once this is done, resources are applied. Fully planned work and applied resources are then compared to the available budget. If the available budget is insufficient for the planned work, either the budget will be increased or the scope of work will be decreased.

A control account authorization is prepared using the project master schedule and the Work Breakdown Structure as guidance. The control account authorization specifies the boundaries of each control account and is used by the senior project manager for planning the work package details. The control account plans and control account authorization are reviewed and approved by the DOE Idaho counterpart, the senior project manager, and other appropriate management. Approval of the control account authorization and control account plan constitutes authority to perform work.

8.2.2 Project Baselines

The project baselines, used for evaluating project performance, are established in the project master schedule and Work Breakdown Structure and are further defined in the control account authorization and cost plan. The various baselines are defined as follows:

- The budget baseline for the project is the sum of the approved budgets on the control account authorizations plus undistributed budgets, which are maintained through the change control system.

- The schedule baseline consists of the key decision points and major milestones displayed on the project master schedule. Key decision points and major milestones are shown in the control accounts that directly support the milestones. Either DOE Headquarters or DOE Idaho defines key milestones, and Bechtel BWXT Idaho, LLC, defines major milestones.

- The scope of baseline or technical baseline is defined in the Work Breakdown Structure and detailed in the total control account authorizations. It is expanded further in design media, operating specifications, and process flow sheets.

- The funds baseline is contained in the annual approved funding program plan. The budget authority is a ceiling for costs plus commitments, and the budget outlay is a ceiling for expenditure during each fiscal year.

8.3 Change Control

The SP-6 team effectively controls changes to the baseline following MCPs and other appropriate guidance. Specifically, SP-6 follows

- MCP-3805, "Trend Program." Trends provide an early warning control tool that precede formal changes, and trends are tracked at least monthly.

- MCP-3416, "Baseline Change Control."

- MCP-3794, "Baseline Management."

- "Planning and Controls Desktop Reference," Section 9 (INEEL 2004c).

The baseline change proposal strategy for the SP-6 project is to focus on the current fiscal year while identifying impacts to scope, schedule, and cost information at a more summary level. As opposed to the baseline change proposal process, the detailed work plan process focuses on the next fiscal year and includes sufficient detail to accurately plan and cost the work for the next 2 fiscal years.

8.4 Communications

The project manager for this project will prepare two types of reports: routine and event reports.

8.4.1 Routine Reports

Weekly and monthly reports will be issued to the DOE Idaho project manager. Reports will contain a summary of work in progress, planned work, problems encountered, results of any change control board or internal change board actions, work stoppages, anticipated schedule variances, work completed, key position changes, status of subcontracts, corrective action plans, audits performed, and earned value reports.

8.4.2 Event Reports

Unusual events may be within the scope of DOE O 231.1A, "Environment, Safety, and Health Reporting." If such events occur, notifications will comply with this order. Unusual events outside the scope of DOE O 231.1A will be reported as follows:

- Minor problems will be reported to the site supervisor and, if necessary, the safety representative.

- Radiological health and safety problems that cannot be corrected onsite will be reported to the site supervisor or the health and safety officer.

- Problems that could stop work for a period of more than one shift, cause a schedule change greater than 2 days, or cause a budget change greater than $5,000 will be reported to the senior project manager. The senior project manager will report these problems to appropriate cost account, project, or program managers, including DOE Idaho.

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Appendix A

Tank Farm Soil and Groundwater Field Sampling Plan for the Operable Unit 3-14 Remedial Investigation/ Feasibility Study

TO VIEW APPENDIX A SEE DOCUMENT NUMBER: DOE/ID-10764, REV.01

Appendix B

Tank Farm Soil and Groundwater Health and Safety Plan for the Operable Unit 3-14 Remedial Investigation/ Feasibility Study

TO VIEW APPENDIX B SEE DOCUMENT NUMBER:
INEEL/EXT-2000-00529, REV.01

Appendix C

Waste Management Plan for the Operable Unit 3-14 Tank Farm Soil and Groundwater Remedial Investigation/Feasibility Study

TO VIEW APPENDIX C SEE DOCUMENT NUMBER:
INEEL/EXT-99-00361, REV.01

Appendix D

Release Site Field Investigation Summaries

Table D-1. CPP-15 field investigation summary.

Release Site: CPP-15

Summary of Release: On March 28, 1974, a liquid (spent solvent) was reportedly found on the ground inside and outside the Solvent Burner Building (CPP-629). A leak of spent solvent was determined to have occurred from the ground surface flange directly above the solvent feed tank for the solvent burner. Quantity of spill is unknown. Subsequent investigation determined that a jet line, used to remove water from the solvent tank, allowed stack condensate to back up the line during construction in the area, overfilling the tank. Beta and gamma radiation readings were as high as 3 R/hr in the contaminated soil, which was removed and placed in drums. Uncontaminated soil was used to backfill the excavation. In 1983 the Solvent Burner Building was dismantled and the furnace/burner unit; furnace duct; control shed; piping, valves and controls within the shed; piping penetrating the shed; solvent feed tank; and contaminated soil in the area were removed. Interviews with demolition personnel indicated the soil excavation exceeded 10 ft below grade and was very thorough, however, no post excavation sampling was performed. The 1993 Track 2 was performed on the basis of the demolition and removal activities and recommended no further action. In September 1995, construction personnel encountered contaminated soil at a depth of 2 ft bgs (up to 43,400 ± 1,800 pCi/g Cs-137). A concrete footer, remnant of the old stack pre-heater had an elevated radiological reading (up to 1.5 R/hr) below the contaminated soil. Soil samples were collected in the area of the contaminated footing. The highest contamination was from Cs-137 at 10.5 ft bgs (586,000 ∀ 170,000 ΔCi/g), which confirmed that not all the contaminated soil was removed in 1983. Estimated Cs-137/Sr-90 released at this site is 466 curies.

Fractional radionuclide activity[a]: 1.6%

Summary of required field investigation: Phase I probehole installation and gamma logging; Phase II sampling and analysis.

	Categories of Decision Inputs				Field Investigation Strategy	
Decision Statements	Extent known adequately to resolve decision statement?	Distribution known adequately to resolve decision statement?	Composition known adequately to resolve decision statement?	Properties[b] known adequately to resolve decision statement?	Phase I	Phase II
1. Determine whether or not soil exposure risks to future workers at CPP-15 exceed allowable levels, requiring control of the exposure pathway.	No. Contamination present at depths < 4 ft bgs and not bounded.	No. Contamination present at depths < 4 ft bgs and distribution not adequately determined.	No. Not sampled for complete TF analyte list; process knowledge incomplete.	Properties information is not needed to resolve Decision Statement 1.	2-4 probeholes or as needed to establish extent to east.	None required.
2. Determine whether or not contaminants are transported out of the tank farm soils to the SRPA at rates sufficient to result in COPC concentrations exceeding allowable levels at the exposure point, requiring control of the exposure pathway.	No. Estimated fractional radionuclide activity comprises > 1% of total estimated TF activity and extent to E not bounded.	No. Estimated fractional radionuclide activity comprises > 1% of total estimated TF activity and distribution not adequately determined.	No. Estimated fractional radionuclide activity comprises > 1% of total estimated TF activity and composition not adequately determined.	No. Need Kd values for groundwater risk COPCs, primarily Pu; also groundwater modeling input data.	2-4 probeholes or as needed to establish extent to east.	One or more coreholes through hot spot based on Phase I results. Sampling and analysis for COPCs identified in Section 3.3.2.
3. Determine whether or not a remedial action that includes [GRA][c] best meets FS evaluation criteria to mitigate excess risks, relative to other alternatives.	No.	No.	No. Need analysis for waste characterization to assess retrieval and disposal alternative.	No. Need treatability study to assess in situ/ex situ treatment.	As stated above.	Collect and analyze continuous core from one boring through hot spot for waste characterization. Collect and archive samples from hot spot for treatability studies.

a. $Fractional\ activity = \frac{Ci_s}{\sum Ci_s} \times 100\%$ where Ci_s is total curies released at a specific site, and $\sum Ci_s$ is total curies released for all tank farm known release sites, based on values cited in Table 3-6. This fractional mass is used to help determine the level of investigation rigor required, and the potential for significant groundwater contamination resulting from a given release site.

b. Properties refer to physicochemical parameters for fate and transport modeling of groundwater contamination source term; and parameters needed to evaluate in situ or ex situ treatment for release sites that present significant risks to groundwater. Knowledge of properties is not needed for sites that do not pose significant groundwater risks based on the estimated fractional radionuclide mass present.

c. General Response Actions (GRAs) to be evaluated include No Action; Institutional Controls; Containment (including capping); Treatment (in situ and ex situ); Retrieval; and Disposal.

Table D-2. CPP-16 field investigation summary.

Release Site: CPP-16

Summary of Release: In January 16, 1976, diverted service wastewater drained out the bottom (5.7 bgs) of an open-bottom valve box to the soil beneath the valve box during a routine transfer from WM-181 to PEW tank WL-102. In 1977 the valve box was replaced with a stainless-steel lined concrete floor and sump valve box that extends 6 ft 9 in bgs. Excavation records were incomplete on what was encountered, and on the extent of soil removed and replaced with backfill. Radiation readings were taken between 5.7 ft bgs and 10.7 ft bgs, which revealed that most of the contamination was 3 ft below the valve box between 5.7 to 8.7 ft bgs (reading up to 19.2 R/hr at 6.7 ft bgs). A gamma scan was performed on one grab sample from the bottom of the valve box, the gamma emitting radionuclides present at the release were Cd-144, Co-60, Cs-134, Cs-137, Eu-154, Ru-106, and Sb-125. The 1992 Track 2 was performed on the information available and recommended No Further Action. Based on a release of 3,200 gal and process knowledge a Cs-137/Sr-90 upper limit of 40.7 curies was released at this site.

Fractional radionuclide activity[a]: <1%.

Summary of required field investigation: No further investigation required.

Decision Statements	Categories of Decision Inputs: Extent known adequately to resolve decision statement?	Distribution known adequately to resolve decision statement?	Composition known adequately to resolve decision statement?	Properties[b] known adequately to resolve decision statement?	Field Investigation Strategy: Phase I	Phase II
1. Determine whether or not soil exposure risks to future workers at CPP-16 exceed allowable levels, requiring control of the exposure pathway.	Yes. No contamination remaining at < 4 ft bgs.	Yes. No contamination remaining at < 4 ft bgs.	Yes. No contamination remaining at < 4 ft bgs.	Properties information is not needed to resolve Decision Statement 1.	None required.	None required.
2. Determine whether or not contaminants are transported out of the tank farm soils to the SRPA at rates sufficient to result in COPC concentrations exceeding allowable levels at the exposure point, requiring control of the exposure pathway.	Yes. Estimated fractional radionuclide activity of original release comprises < 1% of total estimated TF activity.	Yes. Estimated fractional radionuclide activity of original release comprises < 1% of total estimated TF activity.	Yes. Estimated fractional radionuclide activity of original release comprises < 1% of total estimated TF activity.	Yes. Estimated fractional radionuclide activity of original release comprises < 1% of total estimated TF activity.	None required.	None required.
3. Determine whether or not a remedial action that includes [GRA][c] best meets FS evaluation criteria to mitigate excess risks, relative to other alternatives.	Yes. Estimated fractional radionuclide activity of original release comprises < 1% of total estimated TF activity. No RA required.	Yes. Estimated fractional radionuclide activity of original release comprises < 1% of total estimated TF activity. No RA required.	Yes. Estimated fractional radionuclide activity of original release comprises < 1% of total estimated TF activity. No RA required.	Yes. Estimated fractional radionuclide activity of original release comprises < 1% of total estimated TF activity. No RA required.	None required.	None required.

a. $$Fractional\ activity = \frac{Ci_s}{\sum Ci_s} \times 100\%$$

where Ci_s is total curies released at a specific site, and $\sum Ci_s$ is total curies released for all tank farm known release sites, based on values cited in Table 3-6. This fractional mass is used to help determine the level of investigation rigor required, and the potential for significant groundwater contamination resulting from a given release site.

b. Properties refer to physicochemical parameters for fate and transport modeling of groundwater contamination source term; and parameters needed to evaluate in situ or ex situ treatment for release sites that present significant risks to groundwater. Knowledge of properties is not needed for sites that do not pose significant groundwater risks based on the estimated fractional radionuclide mass present.

c. General Response Actions (GRAs) to be evaluated include No Action; Institutional Controls; Containment (including capping); Treatment (in situ and ex situ); Retrieval; and Disposal.

Table D-3. CPP-20 field investigation summary.

Release Site: CPP-20

Summary of Release: Until 1978, acidic (i.e., pH < 2) radioactive liquid waste from INEEL facilities was transported and unloaded via transfer hoses to an underground storage tank just north of building CPP-604. The waste was destined for treatment in the PEW evaporator. Small spills would occasionally occur through holes in the pressurized transfer line as waste was being unloaded, resulting in soil contamination. It has been reported that the spills were cleaned up as they occurred, but no records exist documenting the types, quantities, and locations of the spills or verifying the effectiveness of cleanup activities. The entire CPP-20 area was excavated down to the top of the CPP-604 tank vault (~30 ft below the building access door) in 1982. Reportedly, the bottom 10 ft was backfilled with 5 mR/hr or less soil (backfill source was likely the tank farm) and the remaining 30 ft with clean soil. Portions were excavated a second time between 1983 and 1984. At valve box C-30, contaminated soil was encountered and removed. Reportedly, the bottom 10 ft was backfilled with 3 mR/hr or less soil, and the remainder with clean soil from CFA. In 1992, a Track 2 was performed on the basis that the contaminated soil had been previously removed and recommended for no further action, contingent on the backfill being evaluated in the 1997 OU 3-13 BRA. Characterized soil from the 1993 to 1995 HLWTFR project excavations was used to determine an estimated 0.145 curies of Cs-137/Sr-90 released at this site.

Fractional radionuclide activity[a]: <0.01%

Summary of required field investigation: No further investigation required.

	Categories of Decision Inputs				Field Investigation Strategy	
Decision Statements	Extent known adequately to resolve decision statement?	Distribution known adequately to resolve decision statement?	Composition known adequately to resolve decision statement?	Properties[b] known adequately to resolve decision statement?	Phase I	Phase II
1. Determine whether or not soil exposure risks to future workers at CPP-20 exceed allowable levels, requiring control of the exposure pathway.	Yes. No contamination remaining at < 4 ft bgs.	Yes. No contamination remaining at < 4 ft bgs.	Yes. No contamination remaining at < 4 ft bgs.	Properties information is not needed to resolve Decision Statement 1.	None required.	None required.
2. Determine whether or not contaminants are transported out of the tank farm soils to the SRPA at rates sufficient to result in COPC concentrations exceeding allowable levels at the exposure point, requiring control of the exposure pathway.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity.	None required.	None required.
3. Determine whether or not a remedial action that includes [GRA][c] best meets FS evaluation criteria to mitigate excess risks, relative to other alternatives.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity. No RA required.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity. No RA required.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity. No RA required.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity. No RA required.	None required.	None required.

a. $$\textit{Fractional activity} = \frac{Ci_s}{\sum Ci_s} \times 100\%$$

where Ci_s is total curies released at a specific site, and $\sum Ci_s$ is total curies released for all tank farm known release sites, based on values cited in Table 3-6. This fractional mass is used to help determine the level of investigation rigor required, and the potential for significant groundwater contamination resulting from a given release site.

b. Properties refer to physicochemical parameters for fate and transport modeling of groundwater contamination source term; and parameters needed to evaluate in situ or ex situ treatment for release sites that present significant risks to groundwater. Knowledge of properties is not needed for sites that do not pose significant groundwater risks based on the estimated fractional radionuclide mass present.

c. General Response Actions (GRAs) to be evaluated include No Action; Institutional Controls; Containment (including capping); Treatment (in situ and ex situ); Retrieval; and Disposal.

Table D-4. CPP-24 field investigation summary.

Release Site: CPP-24

Summary of Release: In 1954 in the vicinity of a tank WM-180 riser, a bucket of approximately 1-gal of radioactive waste (400 mR/hr) was accidentally dumped. The spill covered a 3- × 6-ft area. The liquid would have contained mercuric nitrate, nitric acid, and radionuclides. The contamination from the spill was reportedly cleaned up and documented in a radioactivity incident report. Though the exact location of this spill is unknown, radiation surveys in the area revealed no radiation levels above background.

Fractional radionuclide activity[a]: <0.01%

Summary of required field investigation: No further investigation required.

	Categories of Decision Inputs				Field Investigation Strategy	
Decision Statements	Extent known adequately to resolve decision statement?	Distribution known adequately to resolve decision statement?	Composition known adequately to resolve decision statement?	Properties[b] known adequately to resolve decision statement?	Phase I	Phase II
1. Determine whether or not soil exposure risks to future workers at CPP-24 exceed allowable levels, requiring control of the exposure pathway.	Yes. Source removed.	Yes. Source removed.	Yes. Source removed.	Properties information is not needed to resolve Decision Statement 1.	None required.	None required.
2. Determine whether or not contaminants are transported out of the tank farm soils to the SRPA at rates sufficient to result in COPC concentrations exceeding allowable levels at the exposure point, requiring control of the exposure pathway.	Yes. Source removed.	Yes. Source removed.	Yes. Source removed.	Yes. Source removed.	None required.	None required.
3. Determine whether or not a remedial action that includes [GRA][c] best meets FS evaluation criteria to mitigate excess risks, relative to other alternatives.	Yes. Source removed. No RA required.	Yes. Source removed. No RA required.	Yes. Source removed. No RA required.	Yes. Source removed. No RA required.	None required.	None required.

a. $$Fractional\ activity = \frac{Ci_s}{\sum Ci_s} \times 100\%$$

where Ci_s is total curies released at a specific site, and $\sum Ci_s$ is total curies released for all tank farm known release sites, based on values cited in Table 3-6. This fractional mass is used to help determine the level of investigation rigor required, and the potential for significant groundwater contamination resulting from a given release site.

b. Properties refer to physicochemical parameters for fate and transport modeling of groundwater contamination source terms; and to parameters needed to evaluate in situ or ex situ treatment. Knowledge of properties is not needed for sites that do not pose significant groundwater risks based on the estimated fractional radionuclide mass present.

c. General Response Actions (GRAs) to be evaluated include No Action; Institutional Controls; Containment (including capping); Treatment (in situ and ex situ); Retrieval; and Disposal.

Table D-5. CPP-25 field investigation summary.

Release Site: CPP-25

Summary of Release: In August 1960 a transfer line from tank WC-119 to the PEW evaporator feed tank (WL-102) ruptured. An unknown quantity of liquid waste was released adjacent to the north side of building CPP-604. At the time of the incident, radiation readings in the contaminated soil reportedly ranged from 2 to 4 R/hr. Approximately 9 yd^3 of soil was removed after the spill, and the side of the building was washed. No records exist to verify the effectiveness of these cleanup activities. Area was entirely excavated during the 1982 phase of the FPFUP and again partially during the 1983 to 1984 phase. Excavations were reportedly backfilled with clean fill in the upper 30 ft and with 3 to 5 mR soil from 30 to 40 ft. Characterized soil from the 1993 to 1995 HLWTFR project excavations was used to determine an estimated 0.247 curies of Cs-137/Sr-90 released at this site.

Fractional radionuclide activity[a]: < 0.01%

Summary of required field investigation: No further investigation required.

	Categories of Decision Inputs				Field Investigation Strategy	
Decision Statements	Extent known adequately to resolve decision statement?	Distribution known adequately to resolve decision statement?	Composition known adequately to resolve decision statement?	Properties[b] known adequately to resolve decision statement?	Phase I	Phase II
1. Determine whether or not soil exposure risks to future workers at CPP-25 exceed allowable levels, requiring control of the exposure pathway.	Yes. No contamination remaining at < 4 ft bgs.	Yes. No contamination remaining at < 4 ft bgs.	Yes. No contamination remaining at < 4 ft bgs.	Properties information is not needed to resolve Decision Statement 1.	None required.	None required.
2. Determine whether or not contaminants are transported out of the tank farm soils to the SRPA at rates sufficient to result in COPC concentrations exceeding allowable levels at the exposure point, requiring control of the exposure pathway.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity.	None required.	None required.
3. Determine whether or not a remedial action that includes [GRA][c] best meets FS evaluation criteria to mitigate excess risks, relative to other alternatives.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity. No RA required.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity. No RA required.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity. No RA required.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity. No RA required.	None required.	None required.

a. $$\textit{Fractional activity} = \frac{Ci_s}{\sum Ci_s} \times 100\%$$

where Ci_s is total curies released at a specific site, and $\sum Ci_s$ is total curies released for all tank farm known release sites, based on values cited in Table 3-6. This fractional mass is used to help determine the level of investigation rigor required, and the potential for significant groundwater contamination resulting from a given release site.

b. Properties refer to physicochemical parameters for fate and transport modeling of groundwater contamination source term; and parameters needed to evaluate in situ or ex situ treatment for release sites that present significant risks to groundwater. Knowledge of properties is not needed for sites that do not pose significant groundwater risks based on the estimated fractional radionuclide mass present.

c. General Response Actions (GRAs) to be evaluated include No Action; Institutional Controls; Containment (including capping); Treatment (in situ and ex situ); Retrieval; and Disposal.

Table D-6. CPP-26 field investigation summary.

Release Site: CPP-26

Summary of Release: On May 10, 1964 waste lines PUA 1220, 1222, and 1223 (first-cycle extraction) were being decontaminated with steam when a steam leak occurred at a hose coupling connecting the steam line and decontamination header near CPP-635. Approximately 10 to 15 gal of first-cycle raffinate contaminated steam/liquid was released. The site was sprinkled with water to mitigate radiation levels for personal exposure. Sampling was performed on the mud that formed from liquid dripping from the failed coupling. The mud was reportedly cleaned up, solidified, and sent to the RWMC. A surface radiation survey after the 1964 incident detected between 2 and 10 mR/hr in the soil, with one area as high as 200 mR/hr of gross radiation. At most, an upper limit of 120 Ci of Cs-137/Sr-90 contamination may have been released. The 1992 OU 3-07 Track 2 investigation hand augured three boreholes in the tank farm soil near the steam release site. The contamination detected in the three boreholes had concentrations of Cs-137, Sr-90, plutonium, and uranium at 4 to 5 ft below the tank farm liner.

Fractional radionuclide mass[a]: <1.0%

Summary of required field investigation: No further investigation required

	Categories of Decision Inputs				Field Investigation Strategy	
Decision Statements	Extent known adequately to resolve decision statement?	Distribution known adequately to resolve decision statement?	Composition known adequately to resolve decision statement?	Properties[b] known adequately to resolve decision statement?	Phase I	Phase II
1. Determine whether or not soil exposure risks to future workers at CPP-26 exceed allowable levels, requiring control of the exposure pathway.	Yes. Contamination bounded areally.	Yes. Contamination bounded areally.	Yes. Analysis for soil exposure risk drivers performed.	Properties information is not needed to resolve Decision Statement 1.	None.	None.
2. Determine whether or not contaminants are transported out of the tank farm soils to the SRPA at rates sufficient to result in COPC concentrations exceeding allowable levels at the exposure point, requiring control of the exposure pathway.	Yes. Site adequately bounded for groundwater modeling.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity.	None.	None.
3. Determine whether or not a remedial action that includes [GRA][c] best meets FS evaluation criteria to mitigate excess risks, relative to other alternatives.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity. No RA required.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity. No RA required.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity. No RA required.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity. No RA required.	None.	None.

a. $$\textit{Fractional activity} = \frac{Ci_s}{\sum Ci_s} \times 100\%$$

where Ci_s is total curies released at a specific site, and $\sum Ci_s$ is total curies released for all tank farm known release sites, based on values cited in Table 3-6. This fractional mass is used to help determine the level of investigation rigor required, and the potential for significant groundwater contamination resulting from a given release site.

b. Properties refer to physicochemical parameters for fate and transport modeling of groundwater contamination source term; and parameters needed to evaluate in situ or ex situ treatment for release sites that present significant risks to groundwater. Knowledge of properties is not needed for sites that do not pose significant groundwater risks based on the estimated fractional radionuclide mass present.

c. General Response Actions (GRAs) to be evaluated include No Action; Institutional Controls; Containment (including capping); Treatment (in situ and ex situ); Retrieval; and Disposal.

Table D-7. CPP-27 field investigation summary.

Release Site: CPP-27

Summary of Release:

In 1974, a release site from a corroded 12-inch pressure relief line at 12 ft bgs was discovered with soil up to 25 R/hr. It was suspected that the release may have started as early as ~1961 and resulted from two wastes being released. From February 24, 1964, to August 30, 1974, ~115,000 gal of acidic waste (first-cycle aluminum waste) leaked onto the WCF calciner cell floor, which was transferred from WCF to the PEW collection tank. The Cs-137/Sr-90 activity was about 3,000 μCi/mL. It was estimated that < 100 gal of this waste, plus 100 to 300 gal of other waste (rain water, pump-leaked PEW solution, or water from the solvent hold tank) having considerably lower concentrations of radionuclides, were leaked to the soil. An estimated total of 1,000 to 3,000 Ci of activity was released. In 1974 a total of ~275 yd^3 of soil was removed and disposed at the RWMC, leaving an estimated 25 mCi at the site. In 1983, contaminated soil on the northeast corner of this site was encountered and attributed to the corroded line, but from a separate release designated CPP-33. In 1987, 10 observation boreholes were drilled to the basalt to determine the extent of contamination. Direct radiation readings ranged from none detected to 30 mR/hr. The activity at the northern edge of this site was attributed to the contaminated backfill used during excavations and most of the contamination appeared to be in the southwest portion of this site (20 mR/hr at 20 ft bgs). In 1990, a 113-ft borehole, CPP-33-1, was made and analyzed for the full suite of constituents (VOCs, SVOCs, metals, dioxins and furans, cyanide, and radionuclides). Cs-137 and Sr-90 were the primary contaminants and the highest activities were between 7 and 29 ft bgs. This was attributed to contaminated backfill. The estimated Cs-137/Sr-90 activity remaining in the soil based on analytical data is 1.2 Ci.

In 1992 during the OU 3-08 Track 2 investigation of CPP-27, three boreholes (CPP-27-1, CPP-27-2, and CPP-27-3) were drilled and samples collected for VOCs, metals, select anions, pH, and radionuclides. The sample results from CPP-27-1 (drilled to 46-ft bgs) indicate a different source of contamination than the corroded pressure-relief line leak responsible for site CPP-27. Borehole CPP-27-1 encountered contamination at a depth of 6-ft bgs, which is about 6-ft higher than the pressure-relief line leak (12-ft bgs). Elevated levels of Cs-137 and slightly elevated levels of alpha contamination were encountered. Borehole CPP-27-1 was drilled in an area of CPP-27 that was not previously excavated or investigated, but near the base of the Main Stack and the northern edge of former site CPP-29 (discovered in November 1974). Reportedly, site CPP-29 was completely excavated during the 1983 construction of the new main stack's concrete base, which extends over former site CPP-29. Site CPP-29 consisted of two areas of soil contaminated from radioactive liquid (0.6 μCi/mL gross beta, pH 6.8) that leaked from the base of the stack. One soil area was on the north side of the main stack and the other on the west side. The total area was stated to be 8-ft^2 and a few inches deep.

Fractional radionuclide mass[a]: <1.0%

Summary of required field investigation: Phase 2 sampling and analysis.

	Categories of Decision Inputs				Field Investigation Strategy	
Decision Statements	Extent known adequately to resolve decision statement?	Distribution known adequately to resolve decision statement?	Composition known adequately to resolve decision statement?	Properties[b] known adequately to resolve decision statement?	Phase I	Phase II
1. Determine whether or not soil exposure risks to future workers at CPP-27 exceed allowable levels, requiring control of the exposure pathway.	Yes. No contamination present at depths < 4 ft bgs.	Yes. No contamination present at depths < 4 ft bgs.	Yes. No contamination present at depths < 4 ft bgs.	Properties information is not needed to resolve Decision Statement 1.	None.	None.
2. Determine whether or not contaminants are transported out of the tank farm soils to the SRPA at rates sufficient to result in COPC concentrations exceeding allowable levels at the exposure point, requiring control of the exposure pathway.	Yes. Site adequately bounded for groundwater modeling, unless Phase 2 sampling results indicate a separate release.	Yes. Site adequately bounded for groundwater modeling, unless Phase 2 sampling results indicate a separate release.	No. Anomalous contamination at CPP-27-1 may indicate a separate release and should be investigated.	Yes.	None, pending results of Phase 2 sampling.	One corehole to basalt adjacent to CPP-27-1. Sampling and analysis for COPCs identified in Section 3.3.2.
3. Determine whether or not a remedial action that includes [GRA][c] best meets FS evaluation criteria to mitigate excess risks, relative to other alternatives.	Yes, unless Phase 2 sampling results indicate a separate release.	Yes, unless Phase 2 sampling results indicate a separate release.	No. Anomalous contamination at CPP-27-1 may indicate a separate release and should be investigated.	Yes.	None, pending results of Phase 2 sampling	Collect and analyze continuous core from one boring through hot spot for waste characterization. Collect and archive samples from hot spot for treatability studies.

a. $$\textit{Fractional activity} = \frac{Ci_s}{\sum Ci_s} \times 100\%$$

where Ci_s is total curies released at a specific site, and $\sum Ci_s$ is total curies released for all tank farm known release sites, based on values cited in Table 3-6. This fractional mass is used to help determine the level of investigation rigor required, and the potential for significant groundwater contamination resulting from a given release site.

b. Properties refer to physicochemical parameters for fate and transport modeling of groundwater contamination source term; and parameters needed to evaluate in situ or ex situ treatment for release sites that present significant risks to groundwater. Knowledge of properties is not needed for sites that do not pose significant groundwater risks based on the estimated fractional radionuclide mass present.

c. General Response Actions (GRAs) to be evaluated include No Action; Institutional Controls; Containment (including capping); Treatment (in situ and ex situ); Retrieval; and Disposal.

Table D-8. CPP-28 field investigation summary.

Release Site: CPP-28

Summary of Release: Discovered October 1, 1974, site CPP-28 resulted from a 1/8-in inadvertent penetration of a waste transfer line (3"PWA-1005) during construction. Approximately 120-gal of first-cycle waste was released containing about 720 Ci of Cs-137/Sr-90 over a period of about 18 years at a depth of 7 ft bgs. In 1974 soil at 1 R/hr at 6 ft bgs was unearthed during tank farm upgrade activities. The nature and extent of contaminated soil was determined with six soil borings, drilled on October 10, 1974 and sampled for beta-gamma constituents. Trenching operations beginning on October 22, 1974 encountered soil (up to 75 R/hr gross beta-gamma) at depths < 2 ft beneath the encasement. Efforts to excavate to depths below the encasement in the central zone of contaminated soil were abandoned because of handling and exposure problems. A total of 56 yd^3 of contaminated soil containing about half of radionuclide inventory were removed from the release site. After trenching operations, monitoring test pipes were installed at 11 locations up to 20 ft bgs and interval gamma radiation measurements taken. From the data, it was estimated that the zone of soil contamination was ~9 ft in diameter by 2 to 3 ft in average depth below the pipe encasement at 7 ft bgs. Calculations made during the investigation estimated that approximately 128 ft^3 of contaminated soil remained and approximately 360 Ci of Cs-137/Sr-90 activity remained. During the 1982 to 1983 and 1993 to 1994 tank farm upgrades, portions of sites CPP-28, -20, -25, and -79 were excavated. Excavation depths ranged from 0 to 35 ft bgs, with most being completed at approximately 15 ft bgs. Field beta/gamma radiation measurements encountered during excavation ranged from 0 to 5 R/hr. Contamination removed during this construction is believed to be minor.

Fractional radionuclide activity[a]: 1.3%

Summary of required field investigation: Phase II sampling and analysis

	Categories of Decision Inputs				Field Investigation Strategy	
Decision Statements	Extent known adequately to resolve decision statement?	Distribution known adequately to resolve decision statement?	Composition known adequately to resolve decision statement?	Properties[b] known adequately to resolve decision statement?	Phase I	Phase II
1. Determine whether or not soil exposure risks to future workers at CPP-28 exceed allowable levels, requiring control of the exposure pathway.	Yes. No contamination present at depths < 4 ft bgs.	Yes. No contamination present at depths < 4 ft bgs.	Yes. No contamination present at depths < 4 ft bgs.	Properties information is not needed to resolve Decision Statement 1.	None required.	None required.
2. Determine whether or not contaminants are transported out of the tank farm soils to the SRPA at rates sufficient to result in COPC concentrations exceeding allowable levels at the exposure point, requiring control of the exposure pathway.	Yes. Bounded by gamma probes in 1974.	Yes. Determined by gamma probes in 1974.	No. Need analysis for COPCs identified in Section 3.3.2 to assess source term estimate used in 3-13 BRA.	No. Need K_d values for groundwater risk COPCs, primarily Pu; also groundwater modeling data cited in Section 4.2.8.	None required.	Sampling and analysis for COPCs identified in Section 3.3.2. Collect and analyze continuous core from one boring through hot spot.
3. Determine whether or not a remedial action that includes [GRA][c] best meets FS evaluation criteria to mitigate excess risks, relative to other alternatives.	Yes. Bounded by gamma probes in 1974.	Yes. Determined by gamma probes in 1974.	No. Need analysis for waste characterization to assess retrieval and disposal alternative.	No. Need treatability study to assess in situ/ex situ treatment.	None required.	Collect and analyze continuous core from one boring through hot spot for waste characterization. Collect and archive samples from hot spot for treatability studies.

a. $Fractional\ activity = \frac{Ci_s}{\sum Ci_s} \times 100\%$ where Ci_s is total curies released at a specific site, and $\sum Ci_s$ is total curies released for all tank farm known release sites, based on values cited in Table 3-6. This fractional mass is used to help determine the level of investigation rigor required, and the potential for significant groundwater contamination resulting from a given release site.

b. Properties refer to physicochemical parameters for fate and transport modeling of groundwater contamination source term; and parameters needed to evaluate in situ or ex situ treatment for release sites that present significant risks to groundwater. Knowledge of properties is not needed for sites that do not pose significant groundwater risks based on the estimated fractional radionuclide mass present.

c. General Response Actions (GRAs) to be evaluated include No Action; Institutional Controls; Containment (including capping); Treatment (in situ and ex situ); Retrieval; and Disposal.

Table D-9 CPP-30 field investigation summary.

Release Site: CPP-30

Summary of Release: Site CPP-30 was discovered in 1975 and covered an area of 400 ft^2 near valve box B-9 with radiation levels up to 1 R/hr. The area was contaminated during a one-time preventative maintenance activity in which residual decontamination solution from the floor of the valve box contaminated personnel clothing and equipment, which were brought to the surface and inadvertently placed on blotter paper that covered the ground surface. The contamination spread to the soil either through handling or tears in the blotter paper. Reportedly, the contaminated soil was removed, placed in 55-gal drums, and disposed of at the RWMC. Subsequent surface radiation surveys in the area performed in 1991, 1992, and 2001 have not shown radiation levels above background. This site was recommended in the Track 2 investigation as a no further action site, because the entire area has been excavated in the past and the contaminated soil removed.

Fractional radionuclide mass[a]: <1.0%

Summary of required field investigation: No further investigation required.

	Categories of Decision Inputs				Field Investigation Strategy	
Decision Statements	Extent known adequately to resolve decision statement?	Distribution known adequately to resolve decision statement?	Composition known adequately to resolve decision statement?	Properties[b] known adequately to resolve decision statement?	Phase I	Phase II
1. Determine whether or not soil exposure risks to future workers at CPP-30 exceed allowable levels, requiring control of the exposure pathway.	Yes. Source removed.	Yes. Source removed.	Yes. Source removed.	Properties information is not needed to resolve Decision Statement 1.	None required.	None required.
2. Determine whether or not contaminants are transported out of the tank farm soils to the SRPA at rates sufficient to result in COPC concentrations exceeding allowable levels at the exposure point, requiring control of the exposure pathway.	Yes. Source removed.	Yes. Source removed.	Yes. Source removed.	Yes. Source removed.	None required.	None required.
3. Determine whether or not a remedial action that includes [GRA][c] best meets FS evaluation criteria to mitigate excess risks, relative to other alternatives.	Yes. Source removed.	Yes. Source removed.	Yes. Source removed.	Yes. Source removed.	None required.	None required.

a. $$\textit{Fractional activity} = \frac{Ci_s}{\sum Ci_s} \times 100\%$$

where Ci_s is total curies released at a specific site, and $\sum Ci_s$ is total curies released for all tank farm known release sites, based on values cited in Table 3-6. This fractional mass is used to help determine the level of investigation rigor required, and the potential for significant groundwater contamination resulting from a given release site.

b. Properties refer to physicochemical parameters for fate and transport modeling of groundwater contamination source term; and parameters needed to evaluate in situ or ex situ treatment for release sites that present significant risks to groundwater. Knowledge of properties is not needed for sites that do not pose significant groundwater risks based on the estimated fractional radionuclide mass present.

c. General Response Actions (GRAs) to be evaluated include No Action; Institutional Controls; Containment (including capping); Treatment (in situ and ex situ); Retrieval; and Disposal.

Table D-10. CPP-31 field investigation summary.

Release Site: CPP-31

Summary of Release: Site CPP-31 resulted from the release of 14,000-gal of second- and third-cycle extraction waste and evaporator bottoms. The release occurred during a transfer from WM-181 to WM-180 due to valve WRV-147 being open or partially open during the transfer, which corroded a carbon-steel line allowing a release to the soil. In 1975 thirty-three wells were installed to investigate the site. Soil samples were measured for direct radiation and analyzed for radionuclides. The contaminant distribution appears to be associated with zones of preferential movement in the horizontal direction, mainly along waste transfer lines 3"PWA-601/602 connecting valve boxes A-5 and A-6 to WM-182 and waste transfer lines 3"PWA-609/610 buried approximately 11 to12 ft bgs. In the 1980s, ten additional observation wells (81-series) were installed. As a part of the 1992 OU-3-07 Track 2 investigation, radiation profile surveys were performed on 10 existing wells, including eight of the 81 series wells. A comparison of those results to previous subsurface radiation profile measurements were inconclusive as to whether contaminant migration has occurred. Based on the number of monitoring wells installed and their associated radiation profiles, the lateral and vertical extent of the contaminated soil appears to be adequately bounded, with the exception of the area east of valve box A-6 along the piping runs of 3"PWA-1005 and 3"PWA-1030. Monitoring wells A53-18 and A53-25 encountered contaminated soil but did not provide the vertical extent of contamination at those locations. Based on reviews of data from other probes, it is likely that the contamination as measured by gamma-logging does not extend deeper than 25 ft bgs. The volume of soil exceeding a 1 R/hr activity level was estimated to be 800 yd^3 from the 1975 field data. However, a more accurate source term for the CPP-31 release was calculated using process knowledge (DOE\ID 2000). Based on the distribution of radionuclides associated with the WM-181 tank for the 1972 time period approximately 23,800 Ci of Cs-137/Sr-90 activity was released in 1972.

Fractional radionuclide activity[a]: 83%

Summary of required field investigation: Phase II sampling and analysis

	Categories of Decision Inputs				Field Investigation Strategy	
Decision Statements	Extent known adequately to resolve decision statement?	Distribution known adequately to resolve decision statement?	Composition known adequately to resolve decision statement?	Properties[b] known adequately to resolve decision statement?	Phase I	Phase II
1. Determine whether or not soil exposure risks to future workers at CPP-31 exceed allowable levels, requiring control of the exposure pathway.	Yes. No contamination present at depths < 4 ft bgs.	Yes. No contamination present at depths < 4 ft bgs.	Yes. No contamination present at depths < 4 ft bgs.	Properties information is not needed to resolve Decision Statement 1.	None required.	None required.
2. Determine whether or not contaminants are transported out of the tank farm soils to the SRPA at rates sufficient to result in COPC concentrations exceeding allowable levels at the exposure point, requiring control of the exposure pathway.	Yes. Areal and vertical extent bounded by gamma probes.	Yes. Determined by gamma probes in 1974.	No. Need analysis for COPCs identified in Section 3.3.2 to assess source term estimate used in 3-13 BRA.	No. Need K_d values for groundwater risk COPCs, primarily Pu; also groundwater modeling data cited in Section 4.2.8.	None required.	Sampling and analysis for COPCs identified in Section 3.3.2. Collect and analyze continuous core from one boring through hot spot.
3. Determine whether or not a remedial action that includes [GRA][c] best meets FS evaluation criteria to mitigate excess risks, relative to other alternatives.	Yes. Bounded by gamma probes in 1974.	Yes. Determined by gamma probes in 1974.	No. Need analysis for waste characterization to assess retrieval and disposal alternative.	No. Need treatability study to assess in situ/ex situ treatment.	None required.	Collect and analyze continuous core from one boring through hot spot for waste characterization. Collect and archive samples from hot spot for treatability studies.

a. $$Fractional\ activity = \frac{Ci_s}{\sum Ci_s} \times 100\%$$

where Ci_s is total curies released at a specific site, and $\sum Ci_s$ is total curies released for all tank farm known release sites, based on values cited in Table 3-6. This fractional mass is used to help determine the level of investigation rigor required, and the potential for significant groundwater contamination resulting from a given release site.

b. Properties refer to physicochemical parameters for fate and transport modeling of groundwater contamination source term; and parameters needed to evaluate in situ or ex situ treatment for release sites that present significant risks to groundwater. Knowledge of properties is not needed for sites that do not pose significant groundwater risks based on the estimated fractional radionuclide mass present.

c. General Response Actions (GRAs) to be evaluated include No Action; Institutional Controls; Containment (including capping); Treatment (in situ and ex situ); Retrieval; and Disposal.

Table D-11. CPP-32E field investigation summary.

Release Site: CPP-32E

Summary of Release: In December 1976 site CPP-32E was identified from a surface radiation reading of up to 2 R/hr. Located on the southwest side of valve box B-4, this soil site was contaminated from a release of first cycle waste water vapor condensate from the standpipe (air vent tube and view port pipe) that extends out of the valve box B-4. An area of approximately 8 ft^2 and extending to a depth of about 1 ft bgs was contaminated. The contamination is due to the frequent use and wear of valve box B-4. It is unknown if any cleanup of the site occurred after it was discovered. In 1977, this surface release was covered with 2.5 ft of soil and the tank farm membrane. During the OU 3-07 Track 2 investigation in 1992, a borehole was installed at CPP-32E to a depth of 5-ft (top of concrete valve box) and soil samples were collected. During field screening, the highest beta/gamma radiation reading, 900 cpm above background, was detected between 1.4 and 2.9 ft below the membrane about 2.5 ft below the current ground surface. This depth is roughly equivalent to the ground surface at the time of the release. These low contamination levels support the idea that the contaminated soil was removed when it was initially discovered in 1976. At the bottom of the borehole, the beta-gamma radiation had decreased to 250 cpm above background. The samples were analyzed for VOCs, two metals (mercury and cadmium), gamma-emitting radionuclides, gross alpha and gross beta radiation, and Sr-90. The gross alpha concentrations were within normal background, of the gamma-emitting radionuclides, only Cs-137 at concentrations ranging from 133 pCi/g to 277 pCi/g and Eu-154 at concentrations, ranging from 0.456 pCi/g to 0.811 pCi/g were detected. Subsequent installation of another borehole south west of CPP-32 E determined that the release was not extensive. An estimated 0.0017 curies of Cs-137/Sr-90 activity was released.

Fractional radionuclide mass[a]: <0.01%

Summary of required field investigation: No further investigation required.

	Categories of Decision Inputs				Field Investigation Strategy	
Decision Statements	Extent known adequately to resolve decision statement?	Distribution known adequately to resolve decision statement?	Composition known adequately to resolve decision statement?	Properties[b] known adequately to resolve decision statement?	Phase I	Phase II
1. Determine whether or not soil exposure risks to future workers at CPP-32E exceed allowable levels, requiring control of the exposure pathway.	Yes. Bounded by release estimate.	Yes. Bounded by release estimate.	Yes. Bounded by release estimate.	Properties information is not needed to resolve Decision Statement 1.	None.	None.
2. Determine whether or not contaminants are transported out of the tank farm soils to the SRPA at rates sufficient to result in COPC concentrations exceeding allowable levels at the exposure point, requiring control of the exposure pathway.	Yes. Site is adequately bounded for groundwater modeling.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity	None.	None.
3. Determine whether or not a remedial action that includes [GRA][c] best meets FS evaluation criteria to mitigate excess risks, relative to other alternatives.	Yes.	Yes.	Yes.	Yes.	None.	None.

a. $$Fractional\ activity = \frac{Ci_s}{\sum Ci_s} \times 100\%$$

where Ci_s is total curies released at a specific site, and $\sum Ci_s$ is total curies released for all tank farm known release sites, based on values cited in Table 3-6. This fractional mass is used to help determine the level of investigation rigor required, and the potential for significant groundwater contamination resulting from a given release site.

b. Properties refer to physicochemical parameters for fate and transport modeling of groundwater contamination source term; and parameters needed to evaluate in situ or ex situ treatment for release sites that present significant risks to groundwater. Knowledge of properties is not needed for sites that do not pose significant groundwater risks based on the estimated fractional radionuclide mass present.

c. General Response Actions (GRAs) to be evaluated include No Action; Institutional Controls; Containment (including capping); Treatment (in situ and ex situ); Retrieval; and Disposal.

Table D-12.CPP-32W field investigation summary.

Release Site: CPP-32W

Summary of Release: In December 1976 site CPP-32W was identified from a surface radiation reading of up to 2 R/hr. Located ~50-ft northwest of valve Box B-4, this soil site was contaminated from the aboveground 2-in.diameter above ground transfer line temporarily used to pump water from tank vault sumps (slightly contaminated liquids from surface-water seepage (rainfall and snowmelt), vault condensation, and valve leakage) to the PEW evaporator. This area is approximately 6 ft^2 but the depth is not known. It is unknown if any cleanup of the site occurred after it was discovered. Standard tank farm practice would have cleaned up the contamination. In 1977, this surface release was covered with 2.5 ft of soil and the tank farm membrane. During the OU 3-07 Track 2 investigation in 1992 no soil samples were collected from CPP-32W because the exact release location was not known and it was undesirable to penetrate the tank farm membrane unnecessarily. Based on process knowledge an estimated 0.02 curies Cs-137/Sr-90 was released.

Fractional radionuclide mass[a]: <1.0%

Summary of required field investigation: No further investigation required.

	Categories of Decision Inputs				Field Investigation Strategy	
Decision Statements	Extent known adequately to resolve decision statement?	Distribution known adequately to resolve decision statement?	Composition known adequately to resolve decision statement?	Properties[b] known adequately to resolve decision statement?	Phase I	Phase II
1. Determine whether or not soil exposure risks to future workers at CPP-32W exceed allowable levels, requiring control of the exposure pathway.	Yes. Bounded by release estimate.	Yes. Bounded by release estimate.	Yes. Bounded by release estimate.	Properties information is not needed to resolve Decision Statement 1.	None.	None.
2. Determine whether or not contaminants are transported out of the tank farm soils to the SRPA at rates sufficient to result in COPC concentrations exceeding allowable levels at the exposure point, requiring control of the exposure pathway.	Yes. Site is adequately bounded for groundwater modeling.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity.	None.	None.
3. Determine whether or not a remedial action that includes [GRA][c] best meets FS evaluation criteria to mitigate excess risks, relative to other alternatives.	Yes.	Yes.	Yes.	Yes.	None.	None.

a. $$\text{Fractional activity} = \frac{Ci_s}{\sum Ci_s} \times 100\%$$

where Ci_s is total curies released at a specific site, and $\sum Ci_s$ is total curies released for all tank farm known release sites, based on values cited in Table 3-6. This fractional mass is used to help determine the level of investigation rigor required, and the potential for significant groundwater contamination resulting from a given release site.

b. Properties refer to physicochemical parameters for fate and transport modeling of groundwater contamination source term; and parameters needed to evaluate in situ or ex situ treatment for release sites that present significant risks to groundwater. Knowledge of properties is not needed for sites that do not pose significant groundwater risks based on the estimated fractional radionuclide mass present.

c. General Response Actions (GRAs) to be evaluated include No Action; Institutional Controls; Containment (including capping); Treatment (in situ and ex situ); Retrieval; and Disposal.

Table D-13. CPP-33 field investigation summary.

Release Site: CPP-33

Summary of Release: In 1983 release site, CPP-33, was discovered north of site CPP-27. This contamination is thought to be from a separate release involving the 12-in carbon-steel corroded pressure relief line 12 ft bgs associated with CPP-27 that ran from the waste storage tanks to the INTEC stack. From the 1974 investigation of CPP-27, it was suspected that the line was corroded as early as ~1961 from two wastes being released. From February 24, 1964, to August 30, 1974, ~115,000 gal of acidic waste (first-cycle aluminum waste) leaked onto the WCF calciner cell floor, which was transferred from WCF to the PEW collection tank. It was estimated that < 100 gal of this waste, plus 100 to 300 gal of other waste (rain water, pump-leaked PEW solution, or water from the solvent hold tank) having considerably lower concentrations of radionuclides, were leaked to the soil at site CPP-27. In 1983, at site CPP-33, approximately 14,000 yd^3 of soil were removed. Of this total, approximately 2,000 yd^3, exceeding 30 mR/hr of beta-gamma radiation, was removed and disposed of at the RWMC. The remaining 12,000 yd^3 was disposed of in trenches located in the northeast corner of INTEC. The excavated area was backfilled and a portion covered by an asphalt road. Reportedly, some residual contamination remained below and to the sides of the excavated area. This was confirmed by the investigations done within site CPP-27's boundary.

In 1987, 10 observation boreholes were drilled to the basalt at CPP-27, south of CPP-33, to determine the extent of contamination. Direct radiation readings ranged from none detected to 30 mR/hr. The activity at the northern edge of this site was attributed to the contaminated backfill used during excavations and most of the contamination appeared to be in the southwest portion of site CPP-27 (20 mrem at 20 ft bgs). In 1990, a 113-ft borehole, CPP-33-1 (just south of CPP-33), was made and analyzed for the full suite of constituents (VOCs, SVOCs, metals, dioxins and furans, cyanide, and radionuclides). Cs-137 and Sr-90 were the primary contaminants and the highest activities were between 7 and 29 ft bgs. This was attributed to contaminated backfill. In 1992 the OU 3-08 Track 2 investigation placed three boreholes labeled CPP-27-1, CPP-27-2, and CPP-27-3 in site CPP-27 and collected samples for VOCs, metals, select anions, pH, and radionuclides. The low levels of contamination in the northern and eastern edges of this site appear to be from the backfill of the 1983 excavation. An estimated 0.91 curies of Cs-137/Sr-90 activity remained from the release.

Fractional radionuclide mass[a]: <1.0%

Summary of required field investigation: No further investigation required.

	Categories of Decision Inputs				Field Investigation Strategy	
Decision Statements	Extent known adequately to resolve decision statement?	Distribution known adequately to resolve decision statement?	Composition known adequately to resolve decision statement?	Properties[b] known adequately to resolve decision statement?	Phase I	Phase II
1. Determine whether or not soil exposure risks to future workers at CPP-33 exceed allowable levels, requiring control of the exposure pathway.	Yes. Source removed.	Yes. Source removed.	Yes. Source removed.	Properties information is not needed to resolve Decision Statement 1.	None.	None.
2. Determine whether or not contaminants are transported out of the tank farm soils to the SRPA at rates sufficient to result in COPC concentrations exceeding allowable levels at the exposure point, requiring control of the exposure pathway.	Yes. Source removed.	Yes. Source removed.	Yes. Source removed.	Yes. Source removed.	None.	None.
3. Determine whether or not a remedial action that includes [GRA][c] best meets FS evaluation criteria to mitigate excess risks, relative to other alternatives.	Yes.	Yes.	Yes.	Yes.	None.	None.

a. $$Fractional\ activity = \frac{Ci_s}{\sum Ci_s} \times 100\%$$

where Ci_s is total curies released at a specific site, and $\sum Ci_s$ is total curies released for all tank farm known release sites, based on values cited in Table 3-6. This fractional mass is used to help determine the level of investigation rigor required, and the potential for significant groundwater contamination resulting from a given release site.

b. Properties refer to physicochemical parameters for fate and transport modeling of groundwater contamination source term; and parameters needed to evaluate in situ or ex situ treatment for release sites that present significant risks to groundwater. Knowledge of properties is not needed for sites that do not pose significant groundwater risks based on the estimated fractional radionuclide mass present.

c. General Response Actions (GRAs) to be evaluated include No Action; Institutional Controls; Containment (including capping); Treatment (in situ and ex situ); Retrieval; and Disposal.

Table D-14. CPP-58 field investigation summary.

Release Site: CPP-58 (E and W-1954)

Summary of Release: Site CPP-58E resulted from a 1976 release of an estimated 20,000-gal of PEW evaporator condensate due to a failure of a transfer line between the PEW evaporator and the service waste diversion system in CPP-751. The line is buried 6 ft bgs. An estimated 51 mCi of H-3, 0.8 mCi of Sr-90, 4 mCi of Ru-106, 2 mCi of Cs-137, and 1 mCi of Ce-144 (~60 mCi total) were released. The contaminated soil was reportedly left in place and covered with clean soil. Two boreholes were made at the CPP-58E site for the 1992 Track 2 investigation, 13samples were collected and analyzed for VOCs, selected metals (mercury and cadmium), fluoride, nitrate, nitrite, pH, and radionuclides. Cs-137 and Sr-90 were present above background levels below 6 ft bgs, consistent with the release. The analysis indicates the Sr-90 contamination has migrated downward. The contaminated zone is estimated as being present from 6 to 46 ft bgs. Process knowledge was applied to this release to determine a source term for Cs-137/Sr-90 of 2.8 mCi.

Site CPP-58W (1954) is not located at CPP-58, it is west-northwest of the north west corner of CPP-604. The contamination resulted from a release from the 8" cement PEW pipeline damaged during construction activities. The leakage was occurring from joints in the cement pipe that was buried approximately 6 to 8 ft bgs. Radiological readings on the pipe at the release were 25 mR/hr and water in the excavation ditch had a slight amount of contamination. Based on process knowledge a combined Cs-137 and Sr-90 radionuclide content of 26 µCi was released.

In 2001, during TFIA field activities, moist brown material was discovered within the CPP-58E area, which could have been released from the PEW overheads. The material was completely removed and no source was identified. West-southwest of CPP-58W, TFIA field activities discovered radiological contamination with activity levels up to 500 cpm, (drainage system lift station excavation). This radiological contamination is analogous to PEW condensate, the curies determined with process knowledge are included in the release estimates for CPP-58E and -58W. The boundary of CPP-58 was revised to include the contamination discovered in 2001.

Fractional radionuclide mass[a]: <1.0%

Summary of required field investigation: No further investigation required.

Decision Statements	Categories of Decision Inputs				Field Investigation Strategy	
	Extent known adequately to resolve decision statement?	Distribution known adequately to resolve decision statement?	Composition known adequately to resolve decision statement?	Properties[b] known adequately to resolve decision statement?	Phase I	Phase II
1. Determine whether or not soil exposure risks to future workers at CPP-58 exceed allowable levels, requiring control of the exposure pathway.	Yes. No contamination present at depths < 4 ft bgs.	Yes. No contamination present at depths < 4 ft bgs.	Yes. No contamination present at depths < 4 ft bgs.	Properties information is not needed to resolve Decision Statement 1.	None.	None.
2. Determine whether or not contaminants are transported out of the tank farm soils to the SRPA at rates sufficient to result in COPC concentrations exceeding allowable levels at the exposure point, requiring control of the exposure pathway.	Yes. Site adequately bounded for groundwater modeling.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity	None.	None.
3. Determine whether or not a remedial action that includes [GRA][c] best meets FS evaluation criteria to mitigate excess risks, relative to other alternatives.	Yes.	Yes.	Yes.	Yes.	None.	None.

a. $$\textit{Fractional activity} = \frac{Ci_s}{\sum Ci_s} \times 100\%$$

where Ci_s is total curies released at a specific site, and $\sum Ci_s$ is total curies released for all tank farm known release sites, based on values cited in Table 3-6. This fractional mass is used to help determine the level of investigation rigor required, and the potential for significant groundwater contamination resulting from a given release site.

b. Properties refer to physicochemical parameters for fate and transport modeling of groundwater contamination source term; and parameters needed to evaluate in situ or ex situ treatment for release sites that present significant risks to groundwater. Knowledge of properties is not needed for sites that do not pose significant groundwater risks based on the estimated fractional radionuclide mass present.

c. General Response Actions (GRAs) to be evaluated include No Action; Institutional Controls; Containment (including capping); Treatment (in situ and ex situ); Retrieval; and Disposal.

Table D-15. CPP-79-Shallow field investigation summary.

Release Site: CPP-79-Shallow

Summary of Release: Site CPP-79 Shallow resulted from a release of 2,500 gal (an estimated 7 Ci of Cs-137/Sr-90 activity) of dilute calcine decontamination solutions at 10 ft bgs. Two separate releases occurred, in July and August of 1986 from the WCF and NWCF sump tanks to the PEW evaporator feed tank. Based on an investigation in 1986, it was concluded that the missing waste from the two transfers found its way into the soil through leaks in the split clay-tile encasement after the waste backed up into valve box A-2 and flowed to the west into the encasements of 3"PUA-203 and 3"PUA-1013. This waste contained low-level radioactivity, metals, and traces of organic compounds (I-129, 65,000 pCi/L; H-3, 18,900,000 pCi/L; gross beta, 260,000,000 pCi/L; uranium 8.4 E-2 ± 1.1E-2 mg/L). During the OU 3-07 Track 2 investigation in 1992 one soil boring, CPP-79-1, was installed in CPP-79. Based on field monitoring and soil analytical results from borehole CPP-79-1, at a depth between 14 to 22 ft bgs, gross alpha emission is slightly in excess of background levels and gross beta emissions are up to eight times the background level. The low level of radionuclides found at this depth indicates a spill of decontamination solution with dilute radioactivity. Samples collected above 28 ft bgs had relatively low activities of radionuclides, consistent with a release of WCF and NWCF decontamination solutions. The highest gross alpha, beta, and Cs-137 activities were from the sample collected from 14 to 16 ft bgs. The Cs-137 concentration in this sample was 20.9 ± 1.5 pCi/g; the Sr-90 activity was 54.4 ± 3.46 pCi/g. This sample also had detectable levels of U-238 and -235 near background levels and Pu-238 and -239 slightly above background concentrations. The lateral extent of CPP-79 Shallow around borehole CPP-79-1 is provided by the results of samples from boreholes A-61 to the west and A-62 to the east. . The amount of activity was not documented during the excavation activities. Soil was excavated down to an approximate depth of 30 ft below the tank farm surface. Reportedly, the majority of the soils excavated and stockpiled during the 1993-1994 tank farm upgrade were placed back into the excavation, but it is not documented where the soils from the CPP-79 Shallow release were used as backfill. Therefore, the contamination from this release is assumed to still exist in the tank farm and will be included as a part of the source term. An estimated 7.0 curies of Cs-137/Sr-90 activity was released.

Fractional radionuclide mass[a]: <1%

Summary of required field investigation: No further investigation required.

	Categories of Decision Inputs				Field Investigation Strategy	
Decision Statements	Extent known adequately to resolve decision statement?	Distribution known adequately to resolve decision statement?	Composition known adequately to resolve decision statement?	Properties[b] known adequately to resolve decision statement?	Phase I	Phase II
1. Determine whether or not soil exposure risks to future workers at CPP-79 (shallow) exceed allowable levels, requiring control of the exposure pathway.	Yes. No contamination present at depths < 4 ft bgs.	Yes. No contamination present at depths < 4 ft bgs.	Yes. No contamination present at depths < 4 ft bgs.	Properties information is not needed to resolve Decision Statement 1.	None.	None.
2. Determine whether or not contaminants are transported out of the tank farm soils to the SRPA at rates sufficient to result in COPC concentrations exceeding allowable levels at the exposure point, requiring control of the exposure pathway.	Yes. Site adequately bounded for groundwater modeling.	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity	Yes. Fractional radionuclide activity comprises < 1% of total estimated TF activity	None.	None.
3. Determine whether or not a remedial action that includes [GRA][c] best meets FS evaluation criteria to mitigate excess risks, relative to other alternatives.	Yes.	Yes.	Yes.	Yes.	None.	None.

a. $$Fractional\ activity = \frac{Ci_s}{\sum Ci_s} \times 100\%$$

where Ci_s is total curies released at a specific site, and $\sum Ci_s$ is total curies released for all tank farm known release sites, based on values cited in Table 3-6. This fractional mass is used to help determine the level of investigation rigor required, and the potential for significant groundwater contamination resulting from a given release site.

b. Properties refer to physicochemical parameters for fate and transport modeling of groundwater contamination source term; and parameters needed to evaluate in situ or ex situ treatment for release sites that present significant risks to groundwater. Knowledge of properties is not needed for sites that do not pose significant groundwater risks based on the estimated fractional radionuclide mass present.

c. General Response Actions (GRAs) to be evaluated include No Action; Institutional Controls; Containment (including capping); Treatment (in situ and ex situ); Retrieval; and Disposal.

Table D-16. CPP-79 Deep field investigation summary.

Release Site: CPP-79 Deep

Summary of Release: Site CPP-79 Deep (31 to 41 ft bgs) was discovered during the OU 3-07 Track 2 investigation in 1992. One soil boring, CPP-79-1, was installed near the CPP-79 release site. Contamination at this depth is characterized by radionuclide concentrations that are two to three orders of magnitude greater than those detected at CPP-79 Shallow (14 to 30 ft bgs) and may be the result of a release of first, second, and/or third cycle wastes. Samples were collected from CPP-79-1 and screened in the field for gross beta-gamma radiation. Some samples were analyzed for volatile organic compounds (VOCs), mercury, cadmium, nitrate/nitrite, pH, and radionuclides. A sample from 33.5 to 34 ft bgs had a contact surface radiation level of 400 mR/hr beta-gamma. The CPP-79 field logbook indicates the highest measured radioactivity was 1.2 R/hr, which was measured from a sample collected from the 32- to 33.3-ft depth interval at the open end of the split-spoon sampler. Subsequent measurements made in the laboratory where the split-spoon sampler was disassembled under controlled conditions ranged from 400 to 800 mR/hr beta-gamma and 200 to 300 mR/hr beta. The sample measured high gross alpha (8.09E+5 ± 9.71E+4 pCi/g) and beta (1.89E+7 ± 1.52E+6 pCi/g) activities. Isotopic analysis of this soil sample also detected high concentrations of Cs-137 (3.37E+7 ± 1.06E+6 pCi/g), Sr-90 (5.41E+6 ± 4.91E+3 pCi/g), Pu-239/Pu-240 (8.99E+04 pCi/g), Pu-238 (2.76E+05 pCi/g) and Am-241 (1.66E+4 ± 2.18E+3 pCi/g). This analysis shows that CPP-79 Deep's contamination is not from the reported WCF and NWCF decontamination solutions associated with site CPP-79-Shallow. It is also not believed to be from the release at CPP-28. During the 1982 to 1983 tank farm upgrades, the area between CPP-28 and CPP-79 was extensively excavated and there was no evidence of highly contaminated soil between these two sites, which suggests the two sites are independent. The source and release mechanism for the CPP-79 Deep contamination has not been definitively determined. The two boreholes, A-61 and A-62, were installed west and east of CPP-79 in 1993. The contamination encountered at A-61 was above background (field measurement of 10 to 12 mR/hr), and is believed to be from contaminated backfill. Because there is only one highly contaminated soil sample (CPP-79-1) at 32 to 33.3 ft bgs, the extent of contamination both laterally and vertically is not known. Therefore, high and low estimates are provided to help bound the release. Estimated Cs-137/Sr-90 curies remaining after release 3,804 Ci (lower limit) and 13,535 curies (upper limit) (fractional radionuclide mass 35.3% (upper bound estimate)).

Fractional radionuclide mass[a]: 13.3% (lower bound estimate)

Summary of required field investigation: Phase I probing and gamma logging and Phase II sampling.

	Categories of Decision Inputs				Field Investigation Strategy	
Decision Statements	Extent known adequately to resolve decision statement?	Distribution known adequately to resolve decision statement?	Composition known adequately to resolve decision statement?	Properties[b] known adequately to resolve decision statement?	Phase I	Phase II
1. Determine whether or not soil exposure risks to future workers at CPP-79 Deep exceed allowable levels, requiring control of the exposure pathway.	Yes. No contamination present at depths < 4 ft bgs.	Yes. No contamination present at depths < 4 ft bgs.	Yes. No contamination present at depths < 4 ft bgs.	Properties information is not needed to resolve Decision Statement 1.	None.	None.
2. Determine whether or not contaminants are transported out of the tank farm soils to the SRPA at rates sufficient to result in COPC concentrations exceeding allowable levels at the exposure point, requiring control of the exposure pathway.	No. Extent not determined or bounded. Need to determine in order to establish source term because no process knowledge of the release is available.	No. Need to determine to establish source term since no process knowledge of the release is available.	No. Without process knowledge of the release the entire COPC list identified in Section 3.3.2 should be sampled for.	No. Need K_d values for groundwater risk COPCs, primarily Pu; also groundwater modeling data cited in Section 4.2.8.	Probe N to S between CPP-28 and tank vault wall; then W to E bracketing CPP-79-1 (6-8 probeholes or as needed to define extent based on field results). Gamma log to determine areal extent, estimate vertical extent of initial release.	Sampling and analysis for COPCs identified in Section 3.3.2. Collect and analyze continuous core from one boring through hot spot.
3. Determine whether or not a remedial action that includes [GRA][c] best meets FS evaluation criteria to mitigate excess risks, relative to other alternatives.	No. Extent not determined or bounded.	No. Distribution not determined.	No. Need analysis for waste characterization to assess retrieval and disposal alternative.	No. Need treatability study to assess in situ/ex situ treatment.	As stated above.	Collect and analyze continuous core from one boring through hot spot for waste characterization. Collect and archive samples from hot spot for treatability studies.

Table D-16. (continued).

Release Site: CPP-79 Deep
a. $Fractional\ activity = \frac{Ci_s}{\sum Ci_s} \times 100\%$ where Ci_s is total curies released at a specific site, and $\sum Ci_s$ is total curies released for all tank farm known release sites, based on values cited in Table 3-6. This fractional mass is used to help determine the level of investigation rigor required, and the potential for significant groundwater contamination resulting from a given release site.
b. Properties refer to physicochemical parameters for fate and transport modeling of groundwater contamination source term; and parameters needed to evaluate in situ or ex situ treatment for release sites that present significant risks to groundwater. Knowledge of properties is not needed for sites that do not pose significant groundwater risks based on the estimated fractional radionuclide mass present.
c. General Response Actions (GRAs) to be evaluated include No Action; Institutional Controls; Containment (including capping); Treatment (in situ and ex situ); Retrieval; and Disposal.

Appendix E

Evaluation of the Feasibility of an Early Decision and Permanent Remedy for Tank Farm Soil

TO VIEW APPENDIX E SEE DOCUMENT NUMBER:
INEEL/EXT-03-01010, REV.00